STAR

A SEMIMONTHLY ABSTRACT JOURNAL WITH INDEXES

Index Table 3

NOVEMBER 23, 1971

VOLUME 9 • NUMBER 22

N71-35196—N71-36397

PUBLIC DOCUMENTS

DEC 7 1971

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

Perkins Library
Duke University

PURCHASE OF *STAR*

The semimonthly issues and the cumulative index are available postpaid on subscription and in single copy from the Superintendent of Documents, United States Government Printing Office, Washington, D. C. 20402, United States of America.

Semimonthly issues...

Annual subscription rate: $54, domestic; $68.25, foreign. Price per single copy: $2.25, domestic; 25% extra for foreign mailing.

Cumulative index issues...

Annual subscription rate: $23, domestic; $28.75, foreign. Price per single copy varies according to the number of pages.

Domestic subscription rates...

Apply to the United States, Canada, Mexico, and all Central and South American countries, except as noted below.

Foreign subscription rates...

Apply to Argentina, Brazil, French Guiana, Guyana, Surinam, British Honduras, and all other countries throughout the world.

Payment should be by check, money order, or document coupons, and must accompany order. Remittances from foreign countries should be made by international money order, or draft on an American bank, payable to the Superintendent of Documents, or by UNESCO book coupons.

PUBLISHED BY:
UNITED STATES GOVERNMENT
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
SCIENTIFIC AND TECHNICAL INFORMATION OFFICE
Scientific and Technical Aerospace Reports, Volume 9, is prepared by the NASA Scientific and Technical Information Facility operated for the National Aeronautics and Space Administration by Informatics Tisco, Inc.

Use of funds for printing this publication approved by the Director of the Office of Management and Budget March 11, 1971.

INTRODUCTION

A COMPREHENSIVE INFORMATION SERVICE

The National Aeronautics and Space Administration makes the results of worldwide research and development activities in aeronautics, space, and supporting disciplines promptly available to participants in its programs. NASA's scientific and technical information system now contains nearly a million documents, which are abstracted, indexed, and obtainable through retrieval and dissemination services. These services, which include this abstract journal, *Scientific and Technical Aerospace Reports (STAR)*, are described fully in a bulletin, *The NASA Scientific and Technical Information System . . . and How to Use It*, available at no charge from the NASA Scientific and Technical Information Facility, P.O. Box 33, College Park, Maryland 20740.

STAR—A REPORT ABSTRACTING SERVICE

STAR is a comprehensive abstracting and indexing journal covering current worldwide *report* literature on the science and technology of space and aeronautics. Publications abstracted in *STAR* include scientific and technical reports issued by NASA and its contractors, other U.S. Government agencies, and corporations, universities, and research organizations throughout the world. Pertinent theses, NASA-owned patents and patent applications, translations, and other separate documents are also abstracted. Citations and abstracts in *STAR* are grouped in 34 subject categories. Five indexes are included in each issue: subject, personal author, corporate source, contract number, and report/accession number. Cumulative index volumes are published semiannually and annually.

STAR, which is issued on the 8th and 23rd of each month, is available to the public on subscription from the Superintendent of Documents, U.S. Government Printing Office, as noted on the inside cover. *STAR* is sent without charge to:

1. NASA Offices, Centers, contractors, subcontractors, grantees, and consultants;
2. Other U.S. Government agencies and their contractors;
3. Libraries in the United States that have arrangements with NASA to maintain collections of NASA documents for public use;
4. Other organizations in the United States having a need for NASA documents in work related to the aerospace program; and
5. Foreign government or academic organizations that have established appropriate reciprocal arrangements with NASA.

Those eligible to receive *STAR* without charge should address their requests to the NASA Scientific and Technical Information Facility.

ABSTRACTS OF NONREPORT LITERATURE

By arrangement between NASA and the American Institute of Aeronautics and Astronautics, the AIAA publication *International Aerospace Abstracts (IAA)* provides parallel coverage of scientific and trade journals, books, and conference papers in the same subject areas as the reports abstracted in *STAR*. *STAR* and *IAA* are categorized and abstracted in basically identical ways, and documents in both are indexed by terms from the *NASA Thesaurus*. Both journals appear twice monthly. *IAA* is issued on the 1st and 15th of each month.

IAA is available on subscription from the American Institute of Aeronautics and Astronautics, Technical Information Service, 750 Third Avenue, New York New York 10017, at the following annual rates:

Semimonthly issues: United States and Possessions, $110 postpaid; foreign countries, $125 postpaid.

Cumulated index volumes: United States and possessions, $75 postpaid; foreign countries, $90 postpaid.

PUBLIC AVAILABILITY OF DOCUMENTS ANNOUNCED IN STAR

The source of documents announced in *STAR* varies, depending upon the organization which has originated and/or issued the document and the form (paper copy or microfiche[1]) in which the document can be provided. Documents produced by NASA, including its contractor and grantee documents, are identified by an asterisk (*) following the accession number (e.g., N71-10748*). Most of the NASA documents and many of the documents issued by other organizations have had microfiche copies produced. Those documents that can be obtained from some source on microfiche are indicated in *STAR* by the # symbol following the NASA accession number. All documents for which microfiche can be obtained are also available as facsimile or, for some, as printed copies.

Documents that cannot be microfiched but for which one-to-one facsimile can be provided are indicated by a plus (+) instead of the # sign. Documents for which neither the + nor # symbol is shown, and for which no availability other than the issuing activity is given, may present unusual problems of reproducibility. The originator of such a document should be consulted as to its availability.

A source from which a document announced in *STAR* is available to the public is ordinarily given on the last line of the citation. The NASA accession number is sufficient when ordering NASA and NASA-sponsored documents from NTIS. When ordering *non*-NASA documents (no asterisk) from the issuing agency or other sources, particularly NTIS, it is essential that additional bibliographic information such as the report number be given.

The following are the most commonly indicated sources (full addresses of these organizations are listed at the end of this introduction):

Avail: NTIS. Sold by the National Technical Information Service at a standard price of $3.00 for hard copy (printed, facsimile, or reproduced from microcopy) of 300 pages or less. Documents in the 301 to 600 page range are sold for $6.00 in hard copy, and those in the 601 to 900 page range are sold at $9.00. Documents exceeding 900 pages are priced by NTIS on an individual basis. These prices apply retroactively to all documents in the NTIS collection, but in addition, documents of 300 pages or less that are over two years old (from date of announcement in *Government Reports Announcements*, or *STAR* for those items announced only in *STAR*) will have a surcharge of $3.00 added for a total price of $6.00. No additional surcharge will be added for documents over 300 pages.

Microfiche is available from NTIS at a standard price of 95 cents (regardless of age) for those documents identified by the # sign following the accession number (e.g., N71-10411#) and having an NTIS availability shown in the citation. Standing orders for microfiche of (1) the full collection of NTIS-available documents announced in *STAR* with the # symbol, (2) NASA reports only (identified by an asterisk (*)), (3) NASA-accessioned non-NASA reports only (see paragraph below), or (4) any of these classes within one or more *STAR* categories, also may be placed with NTIS at greatly reduced prices per title (e.g., 35 cents) over individual requests. Inquiries concerning NTIS Selective Dissemination of Microfiche (SDM) should be addressed to the Subscription Unit, National Technical Information Service, Springfield, Virginia 22151.

Avail: SOD (or GPO). Sold by the Superintendent of Documents, U.S. Government Printing Office, in hard copy. The price is given following the availability line. (An order received by NTIS for one of these documents will be filled at the SOD price if hard copy is requested. NTIS will also fill microfiche requests, at the standard 95 cent price, for those documents identified by a # symbol.)

(1) A microfiche is a transparent sheet of film, 105 x 148 mm in size, containing up to 72 pages of information reduced to micro images (not to exceed 20:1 reduction).

Avail: NASA Scientific and Technical Information Office. Documents with this availability are usually news releases or informational brochures available without charge in paper copy.

Avail: AEC Depository Libraries. Organizations in U.S. cities and abroad that maintain collections of U.S. Atomic Energy Commission reports, usually in microfiche form, are listed in *Nuclear Science Abstracts*. Services available from the USAEC and its depositories are described in a booklet, *Science Information Available from the Atomic Energy Commission* (TID-4550), which may be obtained without charge from the USAEC Division of Technical Information.

Avail: Univ. Microfilms. Documents so indicated are dissertations selected from *Dissertation Abstracts* and are sold by University Microfilms as xerographic copy (HC) at $10.00 each and microfilm at $4.00 each, regardless of the length of the manuscript. Handling and shipping charges are additional. All requests should cite the author and the Order Number as they appear in the citation.

Avail: USGS. Originals of many reports from the U.S. Geological Survey, which may contain color illustrations, or otherwise may not have the quality of illustrations preserved in the microfiche or facsimile reproduction, may be examined by the public at the libraries of the USGS field offices whose addresses are listed in this Introduction. The libraries may be queried concerning the timely availability of specific documents and the possible utilization of local copying services (e.g., color reproduction).

Avail: HMSO. Publications of Her Majesty's Stationery Office are sold in the U.S. by British Information Services (BIS), New York City. The U.S. price (including a service charge) is given, or a conversion table may be obtained from BIS.

Avail: National Lending Library, Boston Spa, England. Sold by this organization at the price shown. (If none is given, an inquiry should be addressed to NLL.)

Avail: ZLDI. Sold by the Zentralstelle für Luftfahrtdokumentation und -Information, Munich, Federal Republic of Germany, at the price shown in deutschmarks (DM).

Avail: Issuing Activity, or Corporate Author, or no indication of availability: Inquiries as to the availability of these documents should be addressed to the organization shown in the citation as the corporate author of the document.

Avail: U.S. Patent Office. Sold by Commissioner of Patents, U.S. Patent Office, at the standard price of 50 cents each, postage free. (See discussion of patents and patent applications below.)

Other availabilities: If the publication is available from a source other than the above, the publisher and his address will be displayed entirely on the availability line or in combination with the corporate author line.

EUROPEAN AVAILABILITY OF NASA AND AGARD DOCUMENTS

Facsimile copy or microfiche of NASA and NASA-sponsored documents identified by both the symbols "#" and "*" and those AGARD reports that are on microfiche may be purchased from:

ESRO/ELDO Space Documentation Service
European Space Research Organization
114, av. de Neuilly
92-Neuilly-sur-Seine, France

AVAILABILITY OF DOCUMENTS TO REGISTERED NASA INFORMATION USERS

In addition to the common availability of all documents through the above sources, a limited number of information services are provided by NASA to those having a contractual or co-

operative relation to NASA or whose scientific and engineering activities relate to space and aeronautics research. Organizations qualified to receive *STAR* without charge (see p. i) also may qualify for one or more of these services. Organizations that are not registered with NASA and wish to consider registering should request Form 713, Registration Form – Technical Publications, from the NASA Scientific and Technical Information Facility. Subject to the conditions of the approved registration forms, the following services may be made available:

Initial distribution of printed copies of NASA formal reports under specified subject categories. These selected reports, which contain the more significant NASA contributions to scientific or technical knowledge, may be recognized in *STAR* by their report numbers; they include NASA Technical Notes (NASA TN D's), Technical Reports (NASA TR R's), formally published and printed (low numbered) Contractor Reports (NASA CR's), Special Publications (NASA SP's), and selected (low numbered) Technical Translations (NASA TT F's).

Initial distribution of NASA-sponsored documents on microfiche is made to large users of NASA information for whom it would be advantageous to NASA to avoid processing numerous individual requests.

Secondary distribution of NASA reports on microfiche only (i.e., documents in *STAR* designated by both an asterisk (*) and a # symbol), may be obtained on request by registered recipients that do not receive microfiche on initial distribution. Organizations that are qualified to request reports should complete a Form 492, Document Request, for each microfiche request and transmit it to the NASA Scientific and Technical Information Facility.

NASA PATENTS AND PATENT APPLICATIONS

Patents and patent applications owned by NASA are announced in *STAR* under appropriate subject categories and are referenced in the *STAR* indexes. They are identified by U.S. Patent No. and U.S. Patent Appl. Serial No. (SN) in the report/accession number index. The NASA Case number appears in lieu of the report number in the other indexes. In the abstract section of *STAR*, patents and patent applications (those for which no patents have yet been issued) are identified by respective subtitles in the citations.

Copies of NASA *patent application specifications* are sold by the National Technical Information Service at the established unit price of $3.00 for hard copy and 95 cents for microfiche. The NASA accession number should be used for ordering from NTIS.

Microfiche, but not paper copies, of the NASA patent application specifications also are available to registered requesters only at no charge from the NASA Scientific and Technical Information Facility. (Patents, in contrast to the patent applications, are not available as microfiche nor are paper copies of patents available from this source.)

Printed copies of the NASA *patents*, when identified by the U.S. patent number, may be purchased for 50 cents each, postage free, from:

Commissioner of Patents
U.S. Patent Office
Washington, D.C. 20231

It is necessary that payment be remitted in advance, preferably by money order or check payable to the Commissioner of Patents. Prepaid purchase coupons for ordering are also available from the Patent Office.

The patents and patent applications announced in *STAR* are owned by NASA and are available for royalty-free licensing. Requests for licensing terms and further information should be addressed to:

Assistant General Counsel for Patent Matters/Code GP-1
National Aeronautics and Space Administration
Washington, D.C. 20546

COSATI SUBJECT CATEGORY CODE

In the citation of each NASA-supported document and of some non-NASA documents is a code, e.g., CSCL 25A, that indicates the subject category assigned to it from the COSATI Subject Category List (first ed. December, 1964) published by the Committee on Scientific and Technical Information of the Federal Council for Science and Technology.

INDEXING VOCABULARY

The Preliminary Edition of the *NASA Thesaurus* (December 1967) (NASA SP-7030) is used as the authority for the indexing vocabulary that appears in the subject index. The *NASA Thesaurus* should be consulted in examining the current indexing vocabulary, including associated cross-reference structure. Only the subject terms that have been selected to describe the documents abstracted in this issue appear in the subject index. Copies of the *NASA Thesaurus* may be obtained from the National Technical Information Service or the U.S. Government Printing Office at $8.50 for the three-volume set.

SUBSCRIPTION TO NASA-ACCESSIONED NON-NASA MICROFICHE

Organizations that wish to maintain an integrated microfiche file of aerospace-related documents in order by the "N" accession number may obtain on automatic distribution "N"-numbered microfiche of *non*-NASA documents announced in *STAR*. The "N" number is the unique number under which the document is announced in *STAR* as well as indexed in and retrieved from the NASA information store. By special arrangement with NASA, the National Technical Information Service offers, on a subscription basis, the choice of (1) all non-NASA documents announced in *STAR* for which microfiche are available, distributed in "N" accession number sequence, or (2) all non-NASA documents in any one or more of the 34 *STAR* subject categories, distributed in "N" number sequence within each of the categories. The available documents are identified in *STAR* by the "#" symbol but do not show the "*" sign. The non-NASA documents are also available from NTIS in second generation microfiche, individually or by other sequence arrangements, under the originator's accession number ("AD," "PB," etc.). Inquiries for additional information and prices should be directed to: Subscription Unit, National Technical Information Service, Springfield, Virginia 22151.

ADDRESSES OF ORGANIZATIONS

American Institute of Aeronautics
and Astronautics
Technical Information Service
750 Third Ave.
New York, N.Y. 10017

British Information Service
845 Third Ave.
New York, N.Y. 10022

Commissioner of Patents
U.S. Patent Office
Washington, D.C. 20231

ESRO/ELDO Space Documentation Service
European Space Research Organization
114, av. de Neuilly
92-Neuilly-sur-Seine, France

Her Majesty's Stationery Office
P.O. Box 569, S.E. 1
London, England

NASA Scientific and Technical Information Facility
P.O. Box 33
College Park, Maryland 20740

National Aeronautics and Space Administration
Scientific and Technical Information Office (KSI)
Washington, D.C. 20546

National Lending Library for Science and Technology
Boston Spa, Yorkshire, England

National Technical Information Service
Springfield, Virginia 22151

Superintendent of Documents
U.S. Government Printing Office
Washington, D.C. 20402

University Microfilms
A Xerox Company
300 North Zeeb Road
Ann Arbor, Michigan 48106

University Microfilms, Ltd.
Tylers Green
London, England

U.S. Atomic Energy Commission
Division of Technical Information
P.O. Box 62
Oak Ridge, Tennessee 37830

U.S. Geological Survey
1033 General Services Administration Bldg.
Washington, D.C. 20242

U.S. Geological Survey
601 E. Cedar Avenue
Flagstaff, Arizona 86002

U.S. Geological Survey
345 Middlefield Road
Menlo Park, California 94025

U.S. Geological Survey
Bldg. 25, Denver Federal Center
Denver, Colorado 80225

Zentralstelle für Luftfahrtdokumentation und -Information
8 München 86
Postfach 880
Federal Republic of Germany

Volume 9 Number 22 / November 23, 1971

TABLE OF CONTENTS

Subject Categories

Abstracts in the journal are grouped under the following categories:

page:

01 AERODYNAMICS
Includes aerodynamics of bodies, combinations, internal flow in ducts and turbomachinery; wings, rotors, and control surfaces. For applications see: 02 Aircraft and 31 Space Vehicles. For related information see also: 12 Fluid Mechanics; and 33 Thermodynamics and Combustion. **3537**

02 AIRCRAFT
Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc ; and specific types of complete aircraft (e.g., ground effect machines, STOL and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics. **3538**

03 AUXILIARY SYSTEMS
Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines; hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; 22 Nuclear Engineering; and 28 Propulsion Systems. **3542**

04 BIOSCIENCES
Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology. **3543**

05 BIOTECHNOLOGY
Includes life support systems, human engineering; protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences. **3546**

06 CHEMISTRY
Includes chemical analysis and identification (e.g., spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants. **3549**

07 COMMUNICATIONS
Includes communications equipment and techniques; noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation. **3553**

08 COMPUTERS
Includes computer operation and programming; and data processing. For applications, see specific categories. For related information see also: 19 Mathematics. **3555**

09 ELECTRONIC EQUIPMENT

Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors; integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation. **3558**

10 ELECTRONICS

Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see specific Physics categories. **3562**

11 FACILITIES, RESEARCH AND SUPPORT

Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations. **3563**

12 FLUID MECHANICS

Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion. **3566**

13 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences. **3572**

14 INSTRUMENTATION AND PHOTOGRAPHY

Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders; transducers; aerial photography; and telescopes and cameras. **3581**

15 MACHINE ELEMENTS AND PROCESSES

Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control; reliability; drafting; and materials fabrication, handling, and inspection. **3587**

16 MASERS

Includes applications of masers and lasers. For basic research see: 26 Physics, Solid-State. **3590**

17 MATERIALS, METALLIC

Includes cermets; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see: 06 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics. **3592**

18 MATERIALS, NONMETALLIC

Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics. **3598**

19 MATHEMATICS

Includes calculation methods and theory; and numerical analysis. For applications see specific categories. For related information see also: 08 Computers. **3604**

20 METEOROLOGY
Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences. 3609

21 NAVIGATION
Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications. 3616

22 NUCLEAR ENGINEERING
Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems. 3619

23 PHYSICS, GENERAL
Includes acoustics, cryogenics, mechanics, and optics. For astrophysics see: 30 Space Sciences. For geophysics and related information see also: 13 Geophysics, 20 Meteorology, and 29 Space Radiation. 3627

24 PHYSICS, ATOMIC, MOLECULAR, AND NUCLEAR
Includes atomic, molecular and nuclear physics. For applications see: 22 Nuclear Engineering. For related information see also: 29 Space Radiation. 3630

25 PHYSICS, PLASMA
Includes magnetohydrodynamics. For applications see: 28 Propulsion Systems. 3652

26 PHYSICS, SOLID-STATE
Includes semiconductor theory; and superconductivity. For applications see: 16 Masers. For related information see also: 10 Electronics. 3657

27 PROPELLANTS
Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems. 3661

28 PROPULSION SYSTEMS
Includes air breathing, electric, liquid, solid, and magnetohydrodynamic propulsion. For nuclear propulsion see: 22 Nuclear Engineering. For basic research see: 23 Physics, General; and 33 Thermodynamics and Combustion. For applications see: 31 Space Vehicles. For related information see also: 27 Propellants. 3662

29 SPACE RADIATION
Includes cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts. For related information see also: 13 Geophysics, and 24 Physics, Atomic, Molecular, and Nuclear. 3664

30 SPACE SCIENCES
Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbits and trajectories. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles. 3666

31 SPACE VEHICLES

Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also: 28 Propulsion Systems; and 32 Structural Mechanics. **3673**

32 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic. **3681**

33 THERMODYNAMICS AND COMBUSTION

Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants. **3694**

34 GENERAL

Includes information of a broad nature related to industrial applications and technology, and to basic research; defense aspects; information retrieval; management; law and related legal matters; and legislative hearings and documents. **3698**

SUBJECT INDEX I-1

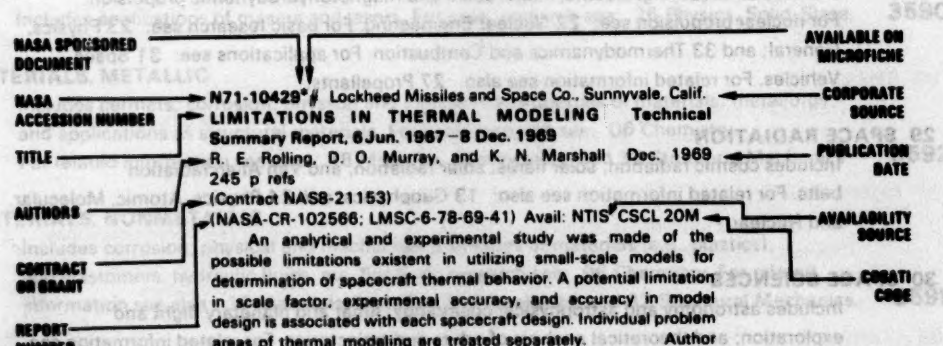
PERSONAL AUTHOR INDEX I-67

CORPORATE SOURCE INDEX I-75

CONTRACT NUMBER INDEX I-91

REPORT/ACCESSION NUMBER INDEX I-95

TYPICAL CITATION AND ABSTRACT FROM *STAR*


NASA SPONSORED DOCUMENT
AVAILABLE ON MICROFICHE
NASA ACCESSION NUMBER
N71-10429*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
CORPORATE SOURCE
TITLE
LIMITATIONS IN THERMAL MODELING Technical Summary Report, 6 Jun. 1967 - 8 Dec. 1969
R. E. Rolling, D. O. Murray, and K. N. Marshall Dec. 1969
PUBLICATION DATE
245 p refs
AUTHORS
(Contract NAS8-21153)
(NASA-CR-102566; LMSC-6-78-69-41) Avail: NTIS CSCL 20M
AVAILABILITY SOURCE
An analytical and experimental study was made of the possible limitations existent in utilizing small-scale models for determination of spacecraft thermal behavior. A potential limitation in scale factor, experimental accuracy, and accuracy in model design is associated with each spacecraft design. Individual problem areas of thermal modeling are treated separately. Author
CONTRACT OR GRANT
COSATI CODE
REPORT NUMBER

VOLUME 9 NUMBER 22 / NOVEMBER 23, 1971

Scientific and Technical Aerospace Reports

A Semimonthly Publication of the National Aeronautics and Space Administration

01 AERODYNAMICS

Includes aerodynamics of bodies, combinations, internal flow in ducts and turbo machinery; wings, rotors, and control surfaces. For applications see: 02 Aircraft and 31 Space Vehicles. For related information see also: 12 Fluid Mechanics; and 33 Thermodynamics and Combustion.

N71-35196*# Cornell Aeronautical Lab., Inc., Buffalo, N.Y.
EXPERIMENTAL INVESTIGATION OF LEADING-EDGE SHOCK IMPINGEMENT AND INTERACTION HEATING ON A 1/80 SCALE MODEL OF A NASA STRAIGHT WING ORBITER CONFIGURATION AT MACH NUMBERS 8 AND 16
C. E. Rogers Aug. 1971 128 p refs
(Contract NAS9-11084)
(NASA-CR-115159; CAL-AA-2977-Y-1) Avail: NTIS CSCL 20D

The leading-edge shock impingement and interaction heating on a 1/80 scale model of a NASA straight-wing orbiter configuration were investigated. The tests were conducted in the 96-inch Hypersonic Shock Tunnel at Mach number 8 (nominal) at Reynolds numbers of 2 million through 10 million per foot and at Mach number 16 at Reynolds numbers of .1 million and 1 million per foot. Model angle of attack was varied from 0 to 70 degrees and model sideslip angle was varied from 0 to 3 degrees. Measurements of chordwise local heat-transfer rates were made at five locations on the wing from the leading edge to 20 percent of the chord length. Sensors were placed to measure the steep gradients occurring in regions where the fuselage bow shock intersected the wing, where interactions from the fuselage were expected and in nondisturbed regions. In addition, measurements of spanwise local heat-transfer rates were made along the 17% chord line to help define the location and magnitude of the impingement and interaction heating. Schlieren photographs were also obtained to help define the flow field. The details of the test program and a description of the model, instrumentation and shock tunnel are presented. The results are presented in tabular and graphical form along with a brief discussion. Author

N71-35197*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
COMPARISONS OF THEORETICAL AND EXPERIMENTAL PRESSURE DISTRIBUTIONS OVER A WING-BODY MODEL AT HIGH SUPERSONIC SPEEDS
Lloyd S. Jernell Washington Sep. 1971 83 p refs
(NASA-TN-D-6480; L-7881) Avail: NTIS CSCL 20D

An investigation was conducted to determine the effectiveness of various theoretical methods in predicting the pressure distribution over a wing-body configuration at high supersonic speeds. Theoretical pressure coefficients are compared with experimental values obtained on delta planform wing-body model at Mach numbers from 2.30 to 4.63 and angles of attack to approximately 11 deg. Author

N71-35198# Advisory Group for Aerospace Research and Development, Paris (France). Structures and Materials Panel.
A COMPARISON OF METHODS USED IN LIFTING SURFACE THEORY
D. L. Woodcock (RAE, Farnborough, Engl.) Jun. 1971 149 p refs Supplement to the Manual on Aeroelasticity, Part 6; see N65-24758
(AGARD-R-583-71) Avail: NTIS

A joint research project organized by the AGARD Structures and Materials Panel is reported. The purpose of the project is to establish the relative merits of different methods of calculating the air forces on oscillating wings, and to provide a standard which can be used in the future for comparison or test purposes. A scheme of cases to be considered was set up which covered variations of the parameters: planform geometry, mach number reduced frequency and mode of oscillation. Contributions came from six countries using nearly thirty different methods and comprising nearly eight hundred calculations. The tabulated results are preceded by descriptions of the various methods used and by a comprehensive system of annotation. Author

N71-35199*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
PRESSURE DISTRIBUTIONS ON A CYLINDRICAL SURFACE BEHIND SHALLOW THREE-DIMENSIONAL REARWARD-FACING STEPS AT MACH NUMBERS FROM 0.4 TO 1.3
Francis J. Capone Washington Sep. 1971 43 p refs
(NASA-TM-X-2402; L-7902) Avail: NTIS CSCL 20D

An investigation has been conducted in transonic tunnel to determine static pressure distributions along a cylindrical surface behind a shallow three-dimensional rearward-facing step of varying height. The ratio of step height to model maximum diameter ahead of the step varied from 0 to 0.27. The investigation was conducted at Mach numbers from 0.4 to 1.3 and at angles of attack from -5 deg to 12 deg. The Reynolds number per meter varied from 4.90 x 1 million to 14.10 x 1 million. Author

N71-35200# Aerospace Research Labs., Wright-Patterson AFB, Ohio.
EFFECT OF UNSYMMETRICAL NOSE-BLUNTNESS OF THE PRESSURE DISTRIBUTION OVER A 10 DEGREE CONE AT MACH 14 Final Report
Otto Walchner, Frank M. Sawyer, and Kevin E. Yelmgren Mar. 1971 46 p refs

(AD-726533; ARL-71-0050) Avail: NTIS CSCL 16/4

The pressure distribution over a 10 deg cone was measured in ARL'S 20-inch hypersonic wind tunnel at Mach-14 and for various angles of attack and sideslip. The effect of different unsymmetrically blunted noses, with small bluntness ratios, on the pressure distribution is investigated. Test results relate any small unsymmetrical nose bluntness to the rotational symmetry of the flow over a body of revolution at high Mach numbers.
Author (GRA)

N71-35201# Polytechnic Inst. of Brooklyn, Farmingdale, N.Y. Dept. of Aerospace Engineering and Applied Mechanics.
VISCOUS FLOW ALONG A CORNER. PART 3. EFFECTS OF AXIAL PRESSURE GRADIENT
Bernard Grossman and Stanley G. Rubin Feb. 1971 70 p refs
(Grant AF-AFOSR-1843-70)
(AD-726546; PIBAL-71-4; AFOSR-71-0074TR) Avail: NTIS CSCL 20/4

The laminar, incompressible flow along a corner formed by the intersection of two thin airfoils is considered. The effects of small axial pressure gradients on the flow in the vicinity of the corner are determined as a perturbation to the flow along a corner formed by intersecting flat plates. The method of matched asymptotic expansions is used to determine the cross-flow induced second-order boundary-layer flow away from the corner, and these results serve as the asymptotic boundary conditions for the corner-layer analysis. The effects of both favorable and adverse pressure gradients on the cross flow are discussed. The corner-layer equations are solved numerically with a relaxation procedure. The results for the corners formed by intersecting thin wedges and intersecting Joukowski airfoils indicate that there are substantial interference effects even for very thin airfoil shapes, i.e., small axial pressure gradients. Author (GRA)

N71-35202# West Virginia Univ., Morgantown. Dept. of Aerospace Engineering.
ANALYSIS OF A CIRCULATION CONTROLLED ELLIPTICAL AIRFOIL
Jack P. Ambrosiani and Nathan Ness Apr. 1971 186 p refs
(Contract N00014-68-A-0512; Proj. Themis)
(AD-726434; TR-30) Avail: NTIS CSCL 20/4

The effect of trailing edge blowing on the circulation around an airfoil section is considered theoretically. The analysis is self-contained in that specification of the ambient conditions, flight conditions, and blowing conditions gives the sectional lift and drag coefficients on the prescribed airfoil section. The method of solution is an iterative one, and involves the matching of an assumed sectional lift coefficient with the sectional lift coefficient calculated from the actual pressure distribution over the body in the presence of trailing edge blowing. In order to obtain the pressure on the wall in the wall jet region a full boundary layer analysis is required over the airfoil. The Karmen-Pohlhausen integral method is used in the laminar region and the Nash and Hicks turbulent layer analysis is used in the turbulent region. Using the boundary layer properties on the upstream side of the wall jet, along with conservation of mass and momentum relations through the mixing zone, a new wall jet profile is found at the downstream end of the potential core. The wall jet region is then analyzed using integral methods including entrainment. The analysis represents an extension to the calculation method proposed by Kind, and reconfirms the feasibility of obtaining high lift coefficients with relatively low blowing rates. Author (GRA)

N71-35203 New York Univ., N.Y.
DIFFRACTION OF SHOCK WAVE BY A THIN WING: SYMMETRIC AND ANTISYMMETRIC PROBLEMS
Max Gunzburger (Ph.D. Thesis) 1969 122 p
Avail: Univ. Microfilms Order No. 70-19282

An analytical solution is obtained for the pressure distribution throughout the flow field due to the diffraction of a plane shock wave of arbitrary strength by a thin lifting or nonlifting wing moving in the opposite direction. For symmetric wings, the thickness is represented by a source distribution, while an antisymmetric wing is represented by a vortex distribution. The shock condition is fulfilled by extending the solution behind the shock into the region ahead of the shock and then finding the proper image behind the shock. For symmetric wings, the intensity of the source distribution is directly related to the thickness of the wing. For antisymmetric wings, the intensity of the vortex distribution is related to the inclination of the wing surface by an integral equation which can be reduced for each instant in time to an equivalent integral equation for a three dimensional steady flow. For a two dimensional plate at angle of attack an explicit solution for the pressure is obtained for a special combination of shock strength and wing speed.
Dissert. Abstr.

02 AIRCRAFT

Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics.

N71-35204*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
AERODYNAMICS OF LIFT FAN V/STOL AIRCRAFT
Jerry V. Kirk, Leo P. Hall, and Brent K. Hodder Sep. 1971 8 p refs Prepared in cooperation with Army Mobility Equipment Res. and Develop. Center
(NASA-TM-X-62086) Avail: NTIS CSCL 01B

Lift fans have been shown to be effective for providing direct lift for V/STOL aircraft. The aerodynamic characteristics of podded lift fans located for and aft of the wing to allow higher wing loading and reduce constraints on wing design are discussed. The more important results are summarized, and the induced aerodynamic effects of various pod locations are shown. Because efficient use of the propulsion system may dictate that the fans also be used for high-speed cruise, the effectiveness of various methods for vectoring the fan flow from the cruise to the lift direction for low-speed transition is presented. An investigation was made for the aerodynamic characteristics of a 1.3 pressure ratio lift fan. Noise constraints were not placed on the design and construction of the fan, but subsequent modifications were incorporated to alleviate noise. Measurements of sound are given for the modified and the original fan operating in crossflow. Author

N71-35205*# Goodyear Aerospace Corp., Akron, Ohio.
DESIGN, FABRICATION, AND STATIC TESTING OF FIRST-STAGE ATTACHED INFLATABLE DECELERATOR (AID) MODELS
B. A. Johnson 15 Sep. 1971 106 p refs
(Contract NAS1-10105)
(NASA-CR-111934; GER-15267) Avail: NTIS CSCL 01C

Wind tunnel models of AID canopies were attached directly to a payload in a method which simulated a first-stage AID. All models had 140-deg conical aeroshells as their forebodies, and each model had four spring-actuated forward inlets mounted on the internal hard structure to provide for initial deployment. Full inflation and final pressurization was accomplished by four aft canopy inlets on each model. An inflation test was conducted in an environmental chamber to investigate packaging, deployment, and inflation characteristics of the models prior to wind tunnel testing. Author

N71-35206*# Hamilton Standard Div., United Aircraft Corp., Windsor Locks, Conn.
ADVANCED GENERAL AVIATION PROPELLER STUDY

Rose Worobel and Millard G. Mayo Apr. 1971 211 p refs
(Contract NAS2-5885)
(NASA-CR-114289) Avail: NTIS CSCL 01B

Methods for predicting the performance, noise, weight, and cost of propellers for advanced general aviation aircraft of the 1980 time period were developed and computerized. A propeller sensitivity study based on the computer program is presented for five representative general aviation aircraft. Conceptual design studies are included for three propellers selected from the sensitivity studies to check the weight and cost estimating procedures. Problem areas exist in the methodology defined and follow-on studies are recommended. A listing of the computer program is presented. Author

N71-35207*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PRELIMINARY STUDY OF AN AIR GENERATOR-REMOTE LIFT FAN PROPULSION SYSTEM FOR VTOL TRANSPORTS
James F. Dugan, Jr., Richard P. Krebs, Kestutis C. Civinskas, and Robert C. Evans Aug. 1971 24 p refs
(NASA-TM-X-67916; E-6543) Avail: NTIS CSCL 01B

A simplified mission analysis was performed to evaluate the effects of tip-turbine pressure ratio and lift-fan pressure ratio on payload and noise of a VSTOL airplane. The propulsion system consisted of four 15,000 pound thrust lift fans, eight 7500 pound thrust lift fans, and four air generators which were also used as the cruise engines. A range of 500 statute miles with two takeoffs and landings was selected along with a cruise Mach number of 0.75 at an initial cruise altitude of 25,000 feet. The allowable gross weight was calculated to be 88,700 pounds. Cruise L/D was varied parametrically from 8 to 12 to determine its impact on the propulsion system and payload. Cruise performance calculations showed that the four air generators used as cruise engines provided reasonable cruise performance. A tip-turbine pressure ratio of 4 and a lift fan pressure ratio of 1.15 gave a near maximum payload of 12,600 pounds (62 passengers). From these preliminary results, it is concluded that the remote air generator lift fan propulsion system is a promising VSTOL transport propulsion system. Author

N71-35208*# Dow Chemical Co., Midland, Mich.
DEVELOPMENT AND PRODUCTION OF HIGH-ALTITUDE DECELERATOR, LIGHTWEIGHT LOW PERMEABILITY BRACE MATERIAL Final Report
1971 32 p
(Contract NAS1-10347)
(NASA-CR-111964) Avail: NTIS CSCL 01C

The selection of adhesive and coating formulations and the development of manufacturing sequences and conditions for lightweight low-permeability brace materials for use in high-altitude decelerators are reported. Permeability and physical property data are presented along with formulas and process conditions for Mylar metallizing and Saran coating materials.
J.M.

N71-35209*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
A FLIGHT EVALUATION OF A VTOL JET TRANSPORT UNDER VISUAL AND SIMULATED INSTRUMENT CONDITIONS
Curt A. Holzhauser, Samuel A. Morello, Robert C. Innis, and James M. Patton Aug. 1971 125 p refs
(NASA-TM-X-62083) Avail: NTIS CSCL 01B

A flight investigation was performed with the Dornier DO 31 VTOL transport to evaluate the performance, handling, and operating characteristics that are considered to be important when operating a commercial VTOL transport in the terminal area. The tests concentrated on the transition, approach, and vertical landing. The mixed jet-propulsion system provided a large usable performance envelope that enabled simulated IFR approaches to be made on 7 deg and 12 deg glideslopes. In these approaches management of thrust magnitude and direction was a primary problem, and some form of integrating the controls will be necessary. The handling qualities evaluation pointed out the need for additional research to define flight-path criteria. The aircraft had satisfactory control and stability in hover out of ground effect. The recirculation effects in a vertical landing were large below 15 meters. Author

N71-35210*# Lockheed-Georgia Co., Marietta. Advanced Concepts Dept.
TECHNOLOGY ASSESSMENT OF ADVANCED GENERAL AVIATION AIRCRAFT Final Report
C. H. Hurkamp, W. M. Johnston, and J. H. Wilson Jun. 1971 376 p refs
(Contract NAS2-5972)
(NASA-CR-114339) Avail: NTIS HC $8.00/MF $0.95 CSCL 01B

The potential impact of advanced technology in 1985 on four classes of general aviation aircraft were studied to recommend areas where further research and development will help to realize the potential improvements. The four categories include conventional, STOL and V/STOL performance in 4 to 9 place aircraft, with helicopters included in the study. The requirements for each category are listed. The study procedure of: (1) establishing an optimized design configuration in each category, based on present technology; (2) investigating and pinpointing the most promising areas of applicable technology; (3) applying the selected advanced technology to each of the present technology designs; and (4) assessing the results and making recommendations. The areas of advanced technology include those of aerodynamics, propulsion, structural materials, avionics, flight safety, automatic control, noise, and emission abatement. These are assessed individually and in combination by means of a computerized analysis. The recommended combinations were then studied to determine their potential impact on the overall transportation system, after which, the areas of technical support are recommended. Author

N71-35211# Naval Air Engineering Center, Philadelphia, Pa. Engineering Dept.
INVESTIGATIONS AND TEST OF WIRE ROPE CORE MATERIALS FOR AIRCRAFT ARRESTING ENGINE PURCHASE CABLE
Cosimo D. Daiello and William Clark 21 May 1971 84 p refs
(AD-724284; NAEC-ENG-7461) Avail: NTIS CSCL 13/9

An investigation and test of cores used in purchase cable for aircraft arrestment gear is made to determine if there is a core material superior to that presently used. Consultations with representatives of the wire rope industry and acknowledged authorities in the field of fiber testing, research and development are conducted. Wire rope core materials are selected and tested. Recommendations are made, with requirements for further testing, of possible superior substitutes. Author

N71-35212# Aircraft Research Association, Ltd., Bedford (England).
EXPERIENCE AT ARA ON FREE DROPPING STORES
R. H. Landon Aug. 1971 17 p refs
(Rept-23) Avail: NTIS

The manufacture and testing of dynamically scaled store models for release in transonic wind tunnels is described. Considered in brief detail are some methods adopted in making both light and heavy models in fiberglass using simply constructed dies, and high speed recording techniques. Author

N71-35213*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
DYNAMIC STABILITY DERIVATIVES OF A JET TRANSPORT CONFIGURATION WITH HIGH THRUST-WEIGHT RATIO AND AN EXTERNALLY BLOWN JET FLAP
Sue B. Grafton, Lysle P. Parlett, and Charles C. Smith, Jr. Washington Sep. 1971 82 p refs
(NASA-TN-D-6440; L-7870) Avail: NTIS CSCL 01B

The investigation was conducted to determine the dynamic

stability derivatives of an externally blown jet-flap transport configuration having clustered inboard pod-mounted engines and full-span triple-slotted flaps. The results showed that the model had positive damping in pitch, roll, and yaw up to the stall angle of attack. The application of power resulted in an increase in pitch damping at high angles of attack and a moderate increase in yaw damping for the higher flap deflections but had no consistent effects on roll damping. For a given level of total engine thrust, the damping derivatives were generally not affected by frequency or by having one engine inoperative. Author

N71-35214# Southampton Univ. (England). Inst. of Sound and Vibration Research.
THE LOUDNESS OF SONIC BOOMS HEARD OUTDOORS AS SIMPLE FUNCTIONS OF OVERPRESSURE AND RISE TIME
D. N. May Apr. 1971 34 p refs Sponsored by Min. of Aviation Supply
(ISVR-TR-46) Avail: NTIS

Semiempirical formulae which represent the loudness of sonic booms heard outdoors as functions of their peak overpressures and rise times only, were found to agree well theoretically with the accepted, more complex loudness calculations of Zepler and Harel, and Johnson and Robinson. Moreover, in an experimental assessment using 34 sonic booms and up to 14 subjects, the semiempirical relations correlated with judged loudness at least as well as did the more complex ones. The use of the semiempirical formulae was recommended by virtue of their simplicity. Author (ESRO)

N71-35215# Royal Aircraft Establishment, Farnborough (England).
A NOTE ON THE T-TAIL FLUTTER
K. Washizu et al Apr. 1971 21 p refs Transl. into ENGLISH from J. Aerospace Soc. (Japan), v. 18 1970 p 327-333
(RAE-Lib-Trans-1546) Avail: NTIS

An analysis of T-tail flutter due to dihedral effect of the horizontal tail is presented. The flutter speed is found to be dependent on the angle of attack of the horizontal tail surface. Flutter characteristics of a simplified T-tail are described. Quasi-steady aerodynamic forces are used to represent the dihedral effect of the horizontal tail. Author

N71-35216# Rowland and Co., Haddonfield, N.J.
FUNCTIONAL ANALYSIS OF PILOT WARNING INSTRUMENT CHARACTERISTICS Final Report
George E. Rowland and Carl T. Reichwein Sep. 1971 86 p refs
(Contract DOT-FA69NA-357)
(FAA-RD-71-59; FAA-NA-71-40) Avail: NTIS

The functional analysis of (pilot warning instrument) systems presented is intended to disclose the role of the pilot in such systems and to describe the intricate relationships between the pilot, the PWI, and the operational aeronautical environment. Thirteen general functions are defined and illustrated; five performed by the PWI and eight by the pilot. The PWI functions are exemplified by references to hardware systems in use; the pilot functions are described through the use of mathematical models and empirical data. The general functions of PWI systems are structured into three categories of pilot-PWI systems. The major independent characteristics of these systems are then used to form system generation matrices. It is shown that over 70,000 different systems can be formed from these matrices. Recognizing the impossibility of dealing with such a number of potential PWI systems, an optimization technique and computer simulation layout are described that could be used in the selection of a limited set of optimal PWI characteristics. Author

N71-35217*# Lockheed-Georgia Co., Marietta. Advanced Concepts Dept.
TECHNOLOGY ASSESSMENT OF ADVANCED GENERAL AVIATION AIRCRAFT Summary Report
C. H. Hurkamp, W. M. Johnston, and J. H. Wilson 1971 57 p refs
(Contract NAS2-5972)
(NASA-CR-114338) Avail: NTIS CSCL 01B

The impact of advanced technology applicable to general aviation aircraft for the 1985 time frame is assessed. The influence of advanced technology and new design philosophies on the cost, performance, and operational capabilities of general aviation aircraft is summarized. The four categories include conventional, STOL and V/STOL performance in 4 to 9 place aircraft, and helicopters. The areas of advanced technology include those of aerodynamics, propulsion, structural materials, avionics, flight safety, automatic control, and noise and emission abatement. These were assessed individually and in combination by means of a computerized analysis. The recommended combinations were then studied to determine their potential impact on the overall transportation system, after which the areas of technical support were recommended. Author

N71-35218# Army Test and Evaluation Command, Aberdeen Proving Ground, Md.
AIRBORNE DISSEMINATION DEVICES Final Report
5 Mar. 1971 27 p refs
(AD-726350; MTP-8-3-080) Avail: NTIS CSCL 15/2

Procedures are prescribed for evaluating the functional suitability and compatibility of airborne dissemination devices. Author (GRA)

N71-35219# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PRINCIPLES OF DESIGN OF VERTICAL TAKEOFF AND LANDING AIRCRAFT
F. P. Kurochkin 19 Feb. 1971 456 p refs Transl. into ENGLISH of the book "Osnovy Proektirovaniya Samoletov s Vertikalnym Vzletom i Posadkoy" Moscow, Izd-vo Mashinostroyeniya, 1970 p 1-352
(AD-726572; FTD-MT-24-255-70) Avail: NTIS CSCL 01/3

The book is dedicated to the draft designing of a comparatively new type of aircraft possessing the takeoff and landing properties of helicopters and other flight characteristics peculiar to aircraft. The characteristics of their aerodynamic configurations basic parameters, gravimetric characteristics, and designs with various power plant compositions are examined. Turboprop (TP) and turbojet engines (TJ) (ordinary and special) were used in the composition of the latter both as sustainer and hoisting, and as composite engines accomplishing in one unit the role of the first and the second. Methods are given for calculating the specific vertical takeoff and landing aircraft (VTOL) processes of flight, for example the transfer from vertical flight to horizontal flight and conversely. Author (GRA)

N71-35220# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DESIGN OF STRUCTURAL ELEMENTS OF AIRPLANES AND HELICOPTERS. TEXTBOOK FOR THE PLANNING OF COURSE AND GRADUATE WORK
V. N. Dalin 5 Feb. 1971 129 p refs Transl. into ENGLISH of the book "Proektirovanie Elementov Konstrukteii Samoletov i Vertolatov. Posobie po Kursovomu i Diplomnomu Proektirovaniyu" Moscow, Gosudarstvennoye Nauchno-Tekhnicheskoye Izdatelstvo Oborongiz, 1962 p 1-78
(AD-726586; FTD-MT-24-247-70) Avail: NTIS CSCL 01/3

The book is a reference text on the design of aviation structural elements. It discusses criteria for the selection of materials for the designing of airplanes and helicopters. Techniques for increasing the strength of the materials and for their connection into units and assemblies are discussed against a background of assuring minimum weight and cost. Author (GRA)

N71-35221# Honeywell, Inc., St. Paul, Minn. Research Dept.
A DESIGN PROCEDURE AND HANDLING-QUALITY CRITERIA FOR LITERAL-DIRECTIONAL FLIGHT CONTROL SYSTEMS Final Report, 17 Oct. 1969 - 17 Oct. 1970
Gunter Stein and Allen H. Henke May 1971 276 p refs
(Contract F33615-70-C-1190)
(AD-726584; Rept-12212-FR; AFFDL-TR-70-152) Avail: NTIS CSCL 01/3

The program develops a practical design procedure for aircraft augmentation systems based on quadratic optimal control technology and handling-quality-oriented cost functionals. The procedure is applied to the design of a lateral-directional control system for the F4C aircraft. The design criteria, design procedure, and final control system are validated with a program of formal pilot evaluation experiments. These use 5 x 2 x 3 mixed-design analysis of variance. A reformulated optimal model-following control problem is used as the cornerstone for the procedure. Design criteria are expressed as model differential equations satisfying available handling-quality data. The reformulation includes optimality over multiple flight conditions and constant gain and measurement realizability constraints. A computational algorithm is developed to solve the new optimization problem. The algorithm successfully handled 20th-order F4C lateral-axes dynamics and optimized five flight conditions simultaneously. The results of the validation experiments were fully positive with strong correlation between performance and pilot opinion data. Author (GRA)

N71-35222# School of Aerospace Medicine, Brooks AFB, Tex.
MEDICO-LEGAL EXAMINATION OF AIRPLANE REMNANTS: ITS ROLE IN CAUSAL EVIDENCE [ZNACHENIYE SUDEBNO-MEDITSINSKOV EXSPERTIZY OBLOMKOV SAMOLETA PRI RASSLEDOVANIYE AVIAKATASTROFY]
A. A. Lukash 1971 4 p Transl. into ENGLISH from Sudebno-med. Ekspertiza, Min. Zdravookhr. SSSR (Moscow), v. 11, no. 15, 1968 15 p
(AD-726559; SAM-TT-R-1092-0771) Avail: NTIS CSCL 01/2

A medico-legal examination was undertaken to determine the possible cause of a jet aircraft crash. The remnants of the aircraft and the pilot's body were examined. The results indicated the crash was caused by collision with a bird. The collision caused the hermetic seal of the cabin and the aerodynamic characteristics of the aircraft to be destroyed, resulting in loss of control by the pilot. The examination also revealed that the pilot received head injuries from slivers of glass on impact. E.H.W.

N71-35223# Ohio State Univ. Research Foundation, Columbus.
AIR CUSHION PRESSURE DURING STIFF OPERATION FOR AIR CUSHION LANDING SYSTEM. PART 1: THEORY Technical Report, Jul. 1969 - Jun. 1970
Lit S. Han Wright-Patterson AFB, Ohio AFFDL May 1971 79 p refs
(Contract F33615-69-C-1001)
(AD-726606; AFFDL-TR-71-4-Pt-1) Avail: NTIS CSCL 01/3

The report studies the performance characteristics of the air cushioned landing and takeoff system for aircraft during its stiff-operation mode. Stiff-operation is obtained during the early stage of the takeoff period or the later stage of landing. Its chief feature is that the pneumatic supply chamber of bleed air is in almost parallel configuration with the ground. The supply air flows vertically down through the bleed holes and is then deflected outward. This part of the report contains the theoretical treatment of the problem. The results are in the form of a cushion pressure ratio in terms of the supply (trunk) pressure. Analysis was performed, based on incompressible viscous theory. Author (GRA)

N71-35224# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PRACTICAL AERODYNAMICS AND AIRCRAFT
G. V. Zimin 16 Apr. 1971 228 p refs Transl. into ENGLISH of the book "Prakticheskaya Aerodinamika i Letatelnye Apparaty" Moscow, Red Banner Military Publishing House, 1969 p 1-324
(AD-726580; FTD-HC-23-638-70) Avail: NTIS CSCL 01/1

The monograph is written primarily as an aid to pilots and is divided into three main sections. Part 1 concerns aerodynamic and flight characteristics of supersonic aircraft, with information on the aerodynamics of supersonic velocities and characteristics of the aerodynamic layout and piloting of supersonic aircraft in takeoff and landing stability and controllability at different flight regimes. Part 2 deals with the future development of piloted aircraft giving the basic flight-tactical characteristics of piloted aircraft. Part 3 involves the basic concepts concerning the motion of spacecraft in the gravitational field of planets. Author (GRA)

N71-35225# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
AIRCRAFT ELECTRIFICATION IN CLOUDS AND PRECIPITATION
I. M. Imyanitov 1 Apr. 1971 267 p refs Transl. into ENGLISH from the book 'Elektrizatsiya Samoletov v Oblakakh i Osadkakh" Leningrad, 1970 p 1-211
(AD-726581; FTD-HC-23-544-70) Avail: NTIS CSCL 04/1

When flying in the clouds or during rainfall there may appear corona or even sparks on the surface of the airplane. As a result, strong statics develop, which increase the probability of hitting the airplane by lightning. In some cases, the aerodynamics of the airplane may be subjected to changes. The electrification of the airplane may distort the results of micro-physical observation of the clouds, particularly the measurement of the atmospheric electricity. This volume is the first attempt to cover the subject in all meteorological aspects. An analysis is given of the static electrification of the airplane and cloud parameters is discussed. Experimental data on electrification in different meteorological conditions are given. Author (GRA)

N71-35226# Massachusetts Inst. of Tech., Cambridge. Aeroelastic and Structures Research Lab.
COMPARISON BETWEEN EXPERIMENTAL DATA AND HELICOPTER AIRLOADS CALCULATED USING A LIFTING SURFACE THEORY
Wayne Johnson Jul. 1970 28 p refs
(Contract N00019-69-C-0219)
(AD-726717; ASRL-TR-157-1) Avail: NTIS CSCL 01/1

Results of the calculation of helicopter airloads using a lifting surface theory solution are presented and compared with experimental data. These results indicate that a very accurate wake geometry model will be required in order to make full use of the accuracy of the lifting surface theory solution. It is observed that the experimental vortex induced loads decrease as the vortex moves inboard along the blade; this phenomenon in the behavior of the vortex wake of a rotor requires more investigation. Author (GRA)

N71-35227# Army Test and Evaluation Command, Aberdeen Proving Ground, Md.
AIRCRAFT REFUELING/DEFUELING SYSTEMS Final Report
1 Jul. 1971 17 p
(AD-726672; MTP-7-3-054) Avail: NTIS CSCL 01/3

The document defines procedures to be used in service testing aircraft refueling/defueling systems. Author (GRA)

N71-35228# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
LONG-LINE LOITER: PERSONNEL RETRIEVAL SYSTEM Final Report
Edward A. Behling Mar. 1971 24 p refs
(AD-727007; AMRL-TR-69-140) Avail: NTIS CSCL 06/7

The report covers the use of fixed-wing aircraft employing innovations to free fall and circling-line techniques in the rescue of personnel and delivery and retrieval of equipment. The

technique involves the deployment of a line from the aircraft while a controlled turn is maintained, causing the line to describe a diminishing spiral earthward. Successful launches of dummy weights up to 203 pounds suggest this technique can feasibly be employed in personnel rescue. Included in the testing were various aircraft, altitudes, speeds, lines, and line lengths. Line tensions were measured. Proposed future efforts toward man-rating the system include measurements of launch G forces and the assessment of system reliability. Author (GRA)

N71-35229# Illinois Univ., Urbana. Aviation Research Lab.
AN EXPERIMENTAL INVESTIGATION OF TWO LINEAR RATE FIELD DISPLAYS Technical Report, 1 Dec. 1969 - 30 Nov. 1970
Leon F. Swartzendruber, Fuat Ince, Robert C. Williges, and Stanley N. Roscoe Wright-Patterson AFB, Ohio AFFDL May 1971 37 p refs
(Contract F33615-70-C-1165)
(AD-726643; ARL-71-0007; AFFDL-TR-71-1; AFFDL-TR-71-25) Avail: NTIS CSCL 01/4

An airspeed display and a lateral displacement (runway) display, arranged vertically and horizontally, respectively, were concurrently tracked by relatively inexperienced pilots using a joy stick. On each display the primary indication was a small bend which moved lengthwise. A moire-pattern rate field (RF) moved alongside and with the primary. Each of four experimental conditions included the primary and (a) no RFs, (b) the airspeed RF only, (c) the runway RF only, or (d) both RFs. Response measures for each display include (a) root mean square (RMS) tracking error, (b) latency of initial response, and (c) control reversals. RFs decreased RMS error for the runway display. Latency was faster, and more reversals occurred on the airspeed display than on the runway display. RFs apparently serve an attention gathering function, but this cannot be fully investigated until optimum direction-of-motion relations are determined.
Author (GRA)

03 AUXILIARY SYSTEMS

Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines; hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; 22 Nuclear Engineering; and 28 Propulsion Systems.

N71-35230*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Guidance and Control Div.
PERFORMANCE EVALUATIONS OF A NONFUELED AND A UO2-FUELED CYLINDRICAL THERMIONIC CONVERTER
K. Shimada 1 Aug. 1971 14 p refs
(Contract NAS7-100)
(NASA-CR-121897; JPL-TR-32-1539) Avail: NTIS CSCL 10B

Two cylindrical thermionic energy converters similar to those in a flashlight type thermionic fuel element were tested electrically. One converter was not fueled, but the other was fueled with UO2 imbedded in six pencil-lead-size holes in the emitter, which was made of rhenium. The nonfueled converter was tested primarily for endurance under open-circuit conditions that might occur as a result of a loss of cesium or a broken power lead. The UO2-fueled converter was tested for fuel-converter compatibility under normal operating conditions with an electric load. The nonfueled converter showed no change in its performance during 4000 h of testing, whereas the output current of the UO2-fueled converter degraded 15% during 2400 h of testing at 2000 deg K. Measurements on the UO2-fueled converter showed an increase in the collector work function and an increase in the bare emitter work function, which indicate that the degradation was caused primarily by foreign deposits on the collector, probably uranium that effused from the UO2-fuel through the emitter. Author

N71-35231*# Lockheed Missiles and Space Co., Palo Alto, Calif. Research Lab.
INVESTIGATION OF FEP TEFLON AS A COVER FOR SILICON SOLAR CELLS Final Report, Jul. 1970 - May 1971
S. A. Greenberg, M. McCargo, and W. L. Palmer Aug. 1971 69 p refs
(Contract NAS3-14398)
(NASA-CR-72970; LMSC-D243070) Avail: NTIS CSCL 10A

A program was executed for the purpose of demonstrating the feasibility of using FEP Teflon as a cover for silicon solar cells. A process for heat sealing Type C FEP to silicon solar cells was developed and optimized. Abbreviated and extended environmental tests were conducted on the optimized cells. The effects of high humidity and temperature, thermal shock, and ultraviolet proton and electron irradiation were evaluated. The process was extended to 15-cell modules, which were evaluated under similar environmental conditions. The performance of the FEP-covered cells compared favorably with that of conventional cover glasses. Author

N71-35232*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
TURBINE AND COMPRESSOR PERFORMANCE OF A BRAYTON ROTATING UNIT DURING HOT CLOSED-LOOP OPERATION
Robert Y. Wong, Hugh A. Klaasen, and Robert C. Evans Washington Sep. 1971 27 p refs
(NASA-TM-X-2350; E-6343) Avail: NTIS CSCL 10A

Efficiency estimates of the turbine and compressor components of a Brayton rotating unit (BRU) were made for operation at design temperature, approximately design equivalent speeds, and a range of operating pressure levels. These estimates were made from performance maps obtained from individual component research packages of the BRU turbomachinery. These maps were obtained at nominal design Reynolds number and rotor axial clearances that were smaller than that used in the BRU turbomachinery. Corrections, based on experimental data obtained from the packages for axial clearance, Reynolds number, and seal leakage flow were applied to these maps. Estimated efficiencies were checked by making a power balance on the BRU rotor. Author

N71-35233*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ANALYSIS OF A 35- TO 150-KILOWATT BRAYTON POWER-CONVERSION MODULE FOR USE WITH AN ADVANCED NUCLEAR REACTOR
Paul T. Kerwin Washington Sep. 1971 28 p refs
(NASA-TN-D-6525; E-6352) Avail: NTIS CSCL 18N

Reference parameters were selected for a Brayton power-conversion module with a turbine inlet temperature of 1144 K (2060 R) to be used in a nuclear-reactor-powered system capable of producing up to 450 kilowatts, electric. Unshielded system specific weight is 90 lb/kWe with a specific radiator area of about (30 square feet per kWe) at full power. Author

N71-35234# Fairchild Stratos Corp., Manhattan Beach, Calif. Stratos Div.
POWER PLANT, 1.5 KW DC, TURBINE DRIVEN ORGANIC RANKINE CYCLE Final Technical Report
Eugene E. Shube and William J. Hogan Jun. 1971 248 p refs
(Contract DAAK02-70-C-0107)
(AD-726454; SR-502) Avail: NTIS CSCL 10/2

Development of a 1.5 kW Organic Rankine Cycle Powerplant is described. The cycle operates on FC-75, Perfluoro-2, Butyle Tetrahydrofuran which is vaporized in the super-critical region. It uses a duel alternator, turbine driven, with appropriate power conditioning circuits. Main alternator output voltage is compliant to adjustable current limit controls. Design features which should make the set inaudible in a quiet jungle at 100 meters are described. Although the report contains

component design information and some component test data no full set operation data is provided because the set was not started up. Author (GRA)

N71-35235# Mallory (P. R.) and Co., Inc., Burlington, Mass. Lab. For Physical Science.
LONG SHELF LIFE ORGANIC ELECTROLYTE BATTERY Final Report
L. F. Athearn and A. N. Dey Fort Monmouth, N. J. ECOM Jun. 1971 78 p refs
(Contract DAAB07-70-C-0076)
(AD-726385; ECOM-0076-F; Rept-4) Avail: NTIS CSCL 10/3

The fabrication of prototype organic electrolyte-lithium cells having wide operating temperature range and high energy density has been completed. Seventy of these cells were assembled and delivered for evaluation tests. In tests of samples of these cells carried out at this laboratory, energy densities of 95 watt hours per pound at room temperature and 55 watt hours per pound at -30 C were obtained. Similar cell components were assembled to make fifteen 36 volt batteries with a diameter of 2.75 in. and a height of 5.0 inches. The discharge of a prototype battery at room temperature using the specified discharge regime was performed. Improved cells of the type used to make the 36 volt batteries were tested at room temperature on the specified loads. The contractual objective for charge retention, high efficiency performance following three months storage at 55C, was not attained. Reduced temperature storage is recommended for the cells and batteries. Some redesign of cell and battery structures is required to prevent electrolyte leakage and internal corrosion observed in the delivered end items. Author (GRA)

04 BIOSCIENCES

Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology.

N71-35236*# Baylor Univ., Houston, Tex. Dept. of Psychiatry.
PHYSIOLOGICAL CORRELATES OF OPTIMAL PERFORMANCE Final Report
Robert Roessler 22 Jul. 1971 50 p refs
(Grant NGR-44-003-031)
(NASA-CR-121903) Avail: NTIS CSCL 05E

The potential utility of psychological and physiological variables in predicting human performance during extended periods of stress was investigated under laboratory conditions. One phase was directed toward defining baselines on the psychological, physiological, and performance variables and the determination of their stability over time. The second phase consisted of a situation in which the subject experienced rest-alert periods over a seventy-two hour period to determine the physiological effects. Detailed information concerning types of measurements made on subjects and results of the tests are presented. Author

N71-35237*# Miami Univ., Coral Gables, Fla. Center for Theoretical Studies.
A MECHANISM FOR THE EVOLUTION OF THE GENETIC CODE
Michael Conrad Apr. 1970 12 p refs
(Grant NGL-10-007-010)
(NASA-CR-121896; CTS-B-70-3) Avail: NTIS CSCL 06C

Multiple coding is proposed as a mechanism facilitating the evolution of the genetic code. Multiple coding can occur when several information storing molecules share the same cytoplasm. These molecules may code for different construction machinery, that is, for different coding systems. Initially this will reduce the efficiency of the systems but will not be lethal if good proteins are still produced. An alternative coding system is retained if it can lead to the production of one useful protein. Under certain conditions the information in the genetic molecules associated with the alternate coding system will be rectified, and this coding system will become predominant. Author

N71-35238*# Republic Aviation Div., Fairchild Hiller Corp., Farmingdale, N.Y. Manned Space Systems.
A BASELINE PROTOCOL FOR PERSONAL HYGIENE Final Report
31 Aug. 1971 206 p refs
(Contract NAS9-11509)
(NASA-CR-115181; FRD-3989) Avail: NTIS CSCL 06I

A personal hygiene protocol was promulgated to encompass the needs, desires, and realities of keeping man clean in a confined space. Based on an in depth review of previous personal hygiene involvements, an analysis of cleansing agents, clothing interactions, water requirements and desirable skin conditions, a day-by-day schedule has evolved. It is hoped that by employing bacteriological sampling, psychological questionnaires, and various subject or observer rating schemes, a pattern of acceptable limits and techniques can emerge. Approximately 80 respondees with confinement experience replied to a questionnaire concerned with their confinement. Their responses have formed the basic data pool for this protocol. Baseline conditions will be obtained from a combination of previous inputs and refined by virtue of data contributions to be obtained from upcoming flights and chamber studies. Author

N71-35239*# Food and Drug Administration, Cincinnati, Ohio. Div. of Microbiology.
ECOLOGY AND THERMAL INACTIVATION OF MICROBES IN AND ON INTERPLANETARY SPACE VEHICLE COMPONENTS Quarterly Progress Report, 1 Apr. - 30 Jun. 1971
J. E. Campbell Aug. 1971 8 p
(NASA Order R-36-015-001)
(NASA-CR-121920; QPR-25) Avail: NTIS CSCL 06M

An investigation of thermal inactivation of microbial spores under various moisture temperature conditions is described. It was found that when the moisture level was below 0.5 ml (250 micrograms H2O/ml headspace) at 90 C about 1-1/2 logs of inactivation was observed. Between 250 and 500 micrograms H2O/ml headspace at 90 C, the moisture value had a profound effect on the number of spore survivors, with the greatest effect at 495 micrograms H2O/ml headspace. It is speculated that these conditions encourage the initiation of germination, which in turn renders the organisms sufficiently sensitive to heat so that they are killed almost instantaneously at 90 C. J.M.

N71-35240# Federal Aviation Administration, Oklahoma City, Okla. Civil Aeromedical Inst.
COLOR DEFECTIVE VISION AND THE RECOGNITION OF AVIATION COLOR SIGNAL LIGHT FLASHES
Mark F. Lewis and Jo Ann Stein Jun. 1971 11 p refs
(FAA-AM-71-27) Avail: NTIS

Subjects of varying type and degree of color deficiency were tested on a battery of color tests, including the American Optical H-R-R plates, the Dvorine plates, the Color Threshold Tester, the Farnsworth Lantern, the Farnsworth-Munsell 100-hue, the Farnsworth Panel D-15, the Titmus Vision Tester Color Plate, and an anomaloscope examination. Correlations with a practical test of the ability of subjects to discriminate aviation signal red, white, and green were obtained. The results generally indicated that the Farnsworth Lantern was a superior predictor of performance on the practical test. Author

N71-35241# Federal Aviation Administration, Oklahoma City, Okla. Civil Aeromedical Inst.
AUTOMATED DIFFERENTIAL FLUOROMETRIC ANALYSIS OF NOREPINEPHRINE AND EPINEPHRINE IN BLOOD PLASMA AND URINE
Vincent Fiorica and Russell Moses Apr. 1971 22 p refs

(FAA-AM-71-15) Avail: NTIS

An automated fluorometric trihydroxyindole procedure is described for the measurement of norepinephrine (NE) and epinephrine (E) in blood plasma or urine. The method employs conventional techniques for isolation of the catecholamines by alumina column chromatography. Column eluates are analyzed in an AutoAnalyzer system incorporating two fluorometers. Differentiation of the amines is based on differences in the fluorescence characteristics of the lutines of NE and E. The accuracy (as estimated by recoveries of added amines) and precision of the method are comparable to those reported for other trihydroxyindole techniques. Representative values for urinary excretion and for plasma levels of NE and E compare favorably with values stated in the literature. Author

N71-35242# Federal Aviation Administration, Oklahoma City, Okla. Civil Aeromedical Inst.

COMBINED EFFECTS OF ALTITUDE AND HIGH TEMPERATURE ON COMPLEX PERFORMANCE

W. D. Chiles, P. F. Iampietro, E. A. Higgins, J. A. Vaughan, Georgetta West et al Apr. 1971 14 p refs

(FAA-AM-71-17) Avail: NTIS

Nine well-trained subjects were tested on a complex performance device designed to assess functions of relevance to aircrew activities. The tests, which involved tracking, monitoring, and mental arithmetic, were performed during exposure to altitude (14,000 feet) and heat (60 deg C) both singly and in combination. Several physiological measures were taken. Exposure durations were 30 minutes for each condition with both preand post-testing. The only clear-cut effects of the conditions were significant differences across the environmental conditions on a perceptual-motor tracking task related to manual aircraft control. Altitude was clearly a more powerful variable than temperature in this study. This was evidenced by the fact that performance under the temperature-plus-altitude and the altitude-only conditions were approximately the same; performance under the temperature-only condition was significantly better than performance for either of the other two conditions. Author

N71-35243# Federal Aviation Administration, Oklahoma City, Okla. Civil Aeromedical Institute.

CHANGES IN CARDIOVASCULAR HEALTH PARAMETERS OVER AN EIGHT-YEAR INTERVAL IN AN ATC POPULATION SEGMENT

Michael T. Lategola Apr. 1971 20 p refs

(FAA-AM-71-19) Avail: NTIS

During 1960 to 1963, the Civil Aeromedical Research Institute (CARI) conducted a broad spectrum of biomedical evaluations on a large number of air traffic control (ATC) students. Approximately 1270 of these students (20-50 years of age) underwent biodynamic evaluation of physical fitness. From these data, the relationships of maximum oxygen uptake (MVO2/Kg bw), resting SBP and DBP to age and the FRWI (an obesity indicator) were examined. General data trends indicated an increase in SBP and DBP with age and the FRWI. The MVO2/Kg bw showed a general trend of decrease as both age and the FRWI increased. Relevant data from the current aeromedical certification files were examined. The average weight gain was approximately nine percent. The 1970 resting SBP and DBP also increased with both age and the FRWI. The percent incidence of the 400 pathology code, as well as resting exercise and recovery heart rates, increased with age and the FRWI. Author

N71-35244# Federal Aviation Administration, Washington, D.C. Aeromedical Standards Div.

THE PHILOSOPHY AND LIMITATIONS OF FAA AEROMEDICAL STANDARDS, POLICIES AND PROCEDURES

Gordon K. Norwood Jun. 1971 11 p

(FAA-AM-71-25) Avail: NTIS

Designated Aviation Medical Examiners need available basic information concerning the FAA medical certification system, the philosophy which underlies standards, policy and procedures and certain limitations of the system. It is through such information that errors adverse to safety can be forestalled and differences in opinions between equally dedicated and knowledgeable physicians can be best averted. Regulatory medicine must have orientation different from that in the private practice of medicine. Insofar as these necessary differences and limitations are recognized, the FAA mission of safety and promotion of aviation should be enhanced by a more effective and equitable system of medical certification. Author

N71-35245# Joint Publications Research Service, Washington, D.C.

THE STRUCTURE OF HUMAN THINKING ACTIVITY

O. K. Tikhomirov 3 Sep. 1971 218 p refs Transl. into ENGLISH from the book "Struktura Myslitelnoy Deyatelnosti Cheloveka" Moscow, Univ. Printing House, 1969 p 5-231 See JPRS-52199, 18 Jan. 1971 for Foreword, Chapters 9-11, Conclusion, and Bibliography

(JPRS-53983; JPRS-52199) Avail: NTIS

CONTENTS:

1. THE DEVELOPMENT OF THE GENERAL THEORY OF ACTIVITY p 1-26 refs (See N71-35246 22-04)
2. PSYCHOLOGICAL INVESTIGATIONS AND THE THEORY OF THINKING p 27-49 refs (See N71-35247 22-04)
3. THINKING AND THE THEORY OF INFORMATION p 50-74 refs (See N71-35248 22-04)
4. GAMES AND THEIR PROGRAMMING p 75-109 refs (See N71-35249 22-08)
5. THE MOVEMENT OF THE EYES AND THINKING p 110-144 refs (See N71-35250 22-04)
6. MANUAL THINKING p145-182 refs (See N71-35251 22-04)
7. EMOTIONS AND THOUGHT p 183-209 refs (See N71-35252 22-04)
8. FACTORS CREATING THE OBJECTIVE COMPLEXITY OF HUMAN PROBLEM SOLUTION p 210-219 refs (See N71-35253 22-04)

N71-35246# Joint Publications Research Service, Washington, D.C.

THE DEVELOPMENT OF THE GENERAL THEORY OF ACTIVITY

In its The Struct. of Human Thinking Activity 3 Sep. 1971 p 1-26 refs (See N71-35245 22-04)

Avail: NTIS

Three theories of human behavioral patterns are generalized, including habits, perception, and latent learning capacity. The stage and memory of afferent synthesis are discussed. Formalism of actions and prediction is also considered, along with reverse afferentation and mismatching between goals. J.A.M.

N71-35247# Joint Publications Research Service, Washington, D.C.

PSYCHOLOGICAL INVESTIGATIONS AND THE THEORY OF THINKING

In its The Struct. of Human Thinking Activity 3 Sep. 1971 p 27-49 refs (See N71-35245 22-04)

Avail: NTIS

Various concepts and definitions of the term, thinking, are presented. The psychological concept of thinking as a form of mental activity is analyzed, emphasizing structural unit changes. Four types of intellectual associations are differentiated: (1) similarity, (2) contrast, (3) closeness in time and space, and (4) relationship between concepts. Various psychological studies are briefly summarized. J.A.M.

N71-35248# Joint Publications Research Service, Washington, D.C.

THINKING AND THE THEORY OF INFORMATION

In its The Struct. of Human Thinking Activity 3 Sep. 1971

p 50-74 refs (See N71-38248 22-04)
Avail: NTIS

A wide spread tendency in cybernetics was noted during mental process studies. Visual differential difficulty, degree of training of subject, and compatibility of stimulus and reaction were determined. Objective and subjective information from search acts of individuals was found to be the basis of the thought process. The selectivity of mental activity which is manifested as noncorrespondence of subjective and objective data content was studied, using a difference model and a broad range of theoretical problems. J.A.M.

N71-38248# Joint Publications Research Service, Washington, D.C.
GAMES AND THEIR PROGRAMMING c08
In its The Struct. of Human Thinking Activity 3 Sep. 1971 p 75-109 refs (See N71-38245 22-04)
Avail: NTIS

An analogy between a communications channel and human mental activity is discussed in relation to cybernetics. Chess and the activity of the chess player are characterized. Psychological studies of chess are described, along with computer programming of the game. Games between man and machines are also evaluated. J.A.M.

N71-38250# Joint Publications Research Service, Washington, D.C.
THE MOVEMENT OF THE EYES AND THINKING
In its The Struct. of Human Thinking Activity 3 Sep. 1971 p 110-144 refs (See N71-38245 22-04)
Avail: NTIS

Functions of eye motion, characteristics of orientation zone, and factors determining the zone's volume are discussed. Search tactics in problem solving situations are analyzed, along with mean-end relationships during the solution process of mental problems. Changes in structural activity during memorization are examined, as well as move-selection problems in isolated positions, solution searching with insufficient time, and mechanism development of visual search. J.A.M.

N71-38251# Joint Publications Research Service, Washington, D.C.
MANUAL THINKING
In its The Struct. of Human Thinking Activity 3 Sep. 1971 p 145-182 refs (See N71-38245 22-04)
Avail: NTIS

Human thinking was investigated through problem solving in chess. Tactile activity of blind chess players was studied, using cyclographic method. Game analysis, merging mechanisms, intention predictions, and general structure of the problem solving process are presented, along with verbalized sense in tactile activity and types of semantic formations. Search selectivity and game tree and man and machine searches for problem solutions are also considered. J.A.M.

N71-38252# Joint Publications Research Service, Washington, D.C.
EMOTIONS AND THOUGHT
In its The Struct. of Human Thinking Activity 3 Sep. 1971 p 183-208 refs (See N71-38245 22-04)
Avail: NTIS

Skin resistance during the solution of mental problems is analyzed. Emotional activation and functions are discussed. Time relationships between the beginning of change and appearance of emotional exclamations, beginning of GSR shift (central nervous system mechanism) and verbal statement, and beginning of GSR shift and evaluation of solution attempts by subjects are also presented. J.A.M.

N71-38253# Joint Publications Research Service, Washington, D.C.
FACTORS CREATING THE OBJECTIVE COMPLEXITY OF HUMAN PROBLEM SOLUTION
In its The Struct. of Human Thinking Activity 3 Sep. 1971 p 210-219 refs (See N71-38245 22-04)
Avail: NTIS

The objective complexity of human problem solutions was found difficult to reduce to information processes. The natural and artificial conditions of the problem are given. The cybernetic interpretation is limited to the formal characteristics of the problem structure, abstracting itself from the characteristics of the problem which represents the primary determining factors in human activity for problem solving. J.A.M.

N71-38254# Federal Aviation Administration, Washington, D.C. Civil Aeromedical Inst.
THE SPIRAL AFTEREFFECT. 3: SOME EFFECTS OF PERCEIVED SIZE, RETINAL SIZE, AND RETINAL SPEED ON THE DURATION OF ILLUSORY MOTION
Kevin D. Mehling, William E. Collins, and David J. Schroeder Jul. 1971 12 p refs
(FAA-AM-71-31) Avail: NTIS

Many safety problems encountered in aviation have been attributed to visual illusions. One of the various types of visual illusions, that of apparent motion, includes as an aftereffect the apparent reversed motion of an object after it ceases real movement. Some effects of perceived size, perceived distance, and perceived stimulus speed on the persistence of illusory motion in the spiral aftereffect are discussed. Durations of the illusion were significantly affected by low retinal speeds, by small visual angles, and by perceived size per unit of retinal size. The results suggest that complex interactions of physical and perceptual factors can significantly alter the presence and the magnitude of visual illusions of motion. Author

N71-38255# National Research Council of Canada, Ottawa (Ontario).
THE METABOLISM OF MAGNESIUM-DEFICIENT CELLS OF ESCHERICHIA COLI [UEBER DEN STOFFWECHSEL MAGNESIUMARM GEWACHSENER ZELLEN VON ESCHERICHIA COLI]
T. Guenther et al 1971 21 p refs Transl. into ENGLISH from Z. Physiol. Chem. (Berlin), v. 349, no. 5, 1968 p 623-631
(NRC-TT-1472) Avail: NTIS

Under aerobic and anaerobic conditions, the amount of glucose degraded by Mg(+2) deficient cells of E. coli is decreased to about half that degraded by Mg(+2) rich control cells. This is the result of a decreased permease activity. In Mg(+2) deficient cells of E. coli, the activities of phosphofructo kinase and pyruvate kinase are increased and respiration is decreased. These metabolic changes are specific for Mg(+2) deficiency; they are reversible and disappear after growth on media containing Mg(+2). Author

N71-38256# International Inst. for Scientific Cooperation, Ulm an der Donau (West Germany).
SEMINAR ON CELL AND CELL SYSTEM ECOLOGY
Theodor M. Fliedner Dec. 1970 38 p refs Seminar held in Paris, 13-15 Jun. 1968
(Grant DA-ERO-591-68-G-01)
(AD-720901; ERO-E-14-41-p) Avail: NTIS CSCL 06/3

Contents: Cellular ecology - a new branch of cell physiology; Relevance of cellular ecology for military medicine; Ecological examples of relevance to military medicine at the level of the whole organism (interaction between atmospheric environment and the mammalian organism, interaction between microbial environment and the mammalian organism, interaction between the physico-chemical environment and the mammalian organism); Ecological examples of relevance to military medicine at the cell system level (Wound healing, Ecological problems in cell transplantation). GRA

N71-38257# Research Inst. of National Defence, Stockholm (Sweden).
OBSERVATION DISTANCE AND PROBABILITY OF

DETECTION [OBSERVATIONSAVSTAND OCH UPPTAECKTSSANNOLIKHET]
Boerje Danebrink and Rune Johansson Mar. 1970 20 p In SWEDISH
(FOA-2-C-2375-72) Avail: NTIS

The probability of target detection with respect to the observation distance is discussed. The target was photographed on a terrain model and pictures were displayed by a tachiscope. The time for detection of the photographed target was measured using 32 persons viewing the film from various distances. Results of the trials are presented in tables and graphs. Author

N71-35258# SysteMed Corp., Dayton, Ohio.
PROCEEDINGS OF THE 1ST ANNUAL CONFERENCE ON ENVIRONMENTAL TOXICOLOGY
Dec. 1970 384 p refs Conf. held at Fairborn, Ohio, 9-11 Sep. 1970
(Contract F33615-70-C-1046)
(AD-727022; AMRL-TR-70-102) Avail: NTIS CSCL 06/20

The report is a compilation of the papers presented and the Proceedings of the 1st Annual Conference on Environmental Toxicology, sponsored by the SysteMed Corporation and held in Fairborn, Ohio on 9, 10, and 11 September 1970. Major technical areas discussed included toxicological evaluation of carbon monoxide, methodology, pathology, atmospheric contaminants, and toxicology of propellants and other military chemicals. Author (GRA)

N71-35259# Oregon State Univ., Corvallis. Science Research Inst.
EFFECTS OF MONOMETHYLHYDRAZINE UPON CARBOHYDRATE METABOLISM Final Report, 1 Dec. 1968 - 30 Oct. 1969
F. N. Dost, D. E. Johnson, and C. H. Wang Apr. 1971 21 p refs
(Contract F33615-67-C-1787)
(AD-727008; AMRL-TR-70-61) Avail: NTIS CSCL 06/16

MMH and UDMH in single, high, nonlethal doses and MMH infused at 0.5 mmole/kg/12 hrs cause depression of glucose-14C oxidation apparently at a point prior to entry of glucose into the catabolic sequence. Inhalation of pure oxygen increases the rate of conversion of glucose-6-14C to 14CO2, but does not alter the rate of conversion of other labels of glucose. Author (GRA)

N71-35476# Paris Univ. (France). Faculty of Sciences.
PRIMARY PRODUCTION IN OCEAN BIOLOGY [LA PRODUCTION PRIMAIRE DANS LA BIOLOGIE DES OCEANS]
Bougis and Dallot *In* Assoc. Franc. pour l'Etude et la Develop. des Appl. de l'Energie Solaire Mess. of Solar Energy in Ocean Waters and Ocean Productivity 23 May 1970 19 p In FRENCH (See N71-35472 22-13)
Avail: NTIS

N71-35477# Paris Univ. (France). Faculty of Sciences.
METHODS OF MEASURING PHYTOPLANKTON PRODUCTION [LES METHODES DE MESURE DE LA PRODUCTION DU PHYTOPLANCTON]
P. Nival *In* Assoc. Franc. pour l'Etude et le Develop. des Appl. de l'Energie Solaire Mess. of Solar Energy in Ocean Waters and Ocean Productivity 23 May 1971 37 p In FRENCH (See N71-35472 22-13)
Avail: NTIS

05 BIOTECHNOLOGY

Includes life support systems, human engineering; protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences.

N71-35260*# Montana Univ., Missoula. Cooperative Wildlife Research Unit.
DEVELOPMENT OF SATELLITE-RELATED BIOTELEMETRY EQUIPMENT Progress Report
J. J. Craighead, F. C. Craighead, Jr., and Joel R. Varney 31 Jul. 1971 111 p refs
(Grant NGR-27-002-006)
(NASA-CR-121893) Avail: NTIS CSCL 06B

The radiolocation system developed for use on elk and grizzly bear was used in the Interrogation Recording Location System (IRLS) elk tracking experiment conducted during the spring and summer of 1970. Experience was gained in integrating this equipment with the IRLS collar and in using it to locate the elk both on the ground and from the air to check satellite location data. Techniques were tested for interrogating the IRLS collar from an aircraft which may prove useful as a supplement to satellite interrogations or in helping to locate an animal with a malfunctioning collar. An improved directional antenna and location technique were developed which facilitate location of instrumented animals by aircraft. Physiological instrumentation work was directed toward experiments with black bears in their winter dens. This approach allows efforts to be concentrated on equipment and instrumentation techniques without requiring the expenditure of a large number of man-hours locating and following instrumented animals. At the same time it is providing information on the life history of wild bears. Author

N71-35261*# Michigan Univ., Ann Arbor. Inst. for Social Research.
TIME PRESSURE AND PERFORMANCE OF SCIENTISTS AND ENGINEERS: A FIVE-YEAR PANEL STUDY
Frank M. Andrews and George F. Farris (MIT) [1971] 31 p refs
(Grant NGR-23-005-395)
(NASA-CR-121884) Avail: NTIS CSCL 05E

Time pressure experienced by scientists and engineers predicted several aspects of performance including usefulness, innovation, and productivity. Higher time pressure was associated with above average performance during the five year study, even when supervisory status, education, and seniority were controlled. Performance, however, did not predict well to subsequent reports of time pressure, suggesting a possible causal relationship from pressure to performance. Innovation and productivity (but not usefulness) were low if the pressure experienced was markedly above that desired. The five-year panel data were derived from approximately 100 scientists in a NASA laboratory. Some theoretical and practical implications of the results are discussed. Author

N71-35262*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CREW RADIATION DOSE FROM THE PLUME OF A HIGH IMPULSE GAS-CORE NUCLEAR ROCKET DURING A MARS MISSION
Charles C. Masser 1971 11 p refs Proposed for presentation at 2d Symp. on Uranium Plasmas: Res. and Appl., Atlanta, Nov. 15-17, 1971; sponsored by AIAA
(NASA-TM-X-67927; E-6576) Avail: NTIS CSCL 06R

Analytical calculations were performed to determine the radiation dose rate and total dose to the crew of a gas-core nuclear rocket from the fission fragments located throughout the plume volume. The rocket plume is generated by the products of the reactor and consists of hydrogen, uranium, and fission

fragments. The mission chosen is a manned courier trip to the planet Mars. Five centimeters of lead shielding would reduce the radiation dose by two orders of magnitude thereby protecting the crew. Also additional attenuation is available in the form of liquid hydrogen propellant, spacecraft structure, nuclear fuel, equipment, and stores. Author

N71-35263*# Baylor Univ., Houston, Tex. Coll. of Medicine.
EVALUATION OF THE NEUROPHYSIOLOGICAL ELECTRODE-AMPLIFIER-HARNESS SYSTEM FOR PHYSIOLOGICAL DATA ACQUISITION Final Report
Peter Kellaway [1970] 50 p refs
(Contract NAS9-7237)
(NASA-CR-115132) Avail: NTIS CSCL 06B

The development of a special electrode and harness system for the acquisition of electroencephalogram and other neurophysiologic data during space missions is discussed. The head cap, electrodes, preamplifiers, and harness have the following characteristics: (1) easy application and removal, (2) repeated on-off use during extended periods, (3) comfort when worn for periods up to 24 hours, including 9 hours of continuous sleep, and (4) detection of artifacts produced by such factors as sweating, eye movement, and muscle potentials. Author

N71-35264*+ Beckman Instruments, Inc., Fullerton, Calif. Advanced Technology Operations.
IODINE COLORIMETER Final Report
Jul. 1971 23 p refs
(Contract NAS9-11879)
(NASA-CR-115134; FR-1090-101) Avail: NTIS CSCL 06K

The design and development of an instrument for making rapid, accurate measurements of low concentrations of iodine in spacecraft potable water supplies are described. A direct spectrophotometric technique is used which eliminates the need for additional reagents or complexing agents. This approach offers substantial advantages over the reagent-addition methods commonly used--especially where storage room and reagent degradation (with time) militate against the use of the usual techniques. An advantage of the instrument described is that of requiring very little effort on the part of the operator to make the aqueous iodine measurement as compared with other methods. Author

N71-35265*# Space Age Control, Inc., Palmdale, Calif.
HIGHLY ARTICULATE FULL PRESSURE GLOVE Final Report
Norman B. Foster May 1971 35 p
(Contract NAS2-6154)
(NASA-CR-114365) Avail: NTIS CSCL 06Q

A highly articulate full pressure glove providing maximum digital dexterity, tactility, and stability at an operating pressure of 5 psid was developed. The program encompassed thumb/finger development, glove development, and glove fabrication and assembly. A mini-convoluted nylon/neoprene laminated fabric was developed for the fingers. Axial restraints located in conduits are used to compensate for pneumatic return force in the fingers. Author

N71-35266*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
SPACE SHUTTLE TECHNOLOGY CONFERENCE. VOLUME 2: BIOTECHNOLOGY
3 May 1971 153 p refs Presented at the Space Shuttle Technol. Conf., Phoenix, Ariz., 18 Mar. 1971
(NASA-TM-X-67265; KSC-TR-1114-Vol-2) Avail: NTIS CSCL 06K

CONTENTS:

1. SPACE SHUTTLE ORBITER ENVIRONMENTAL CONTROL AND LIFE SUPPORT SYSTEMS O. T. Stoll (North Am. Rockwell Corp., Downey, Calif.) and A. O. Brouillet (Hamilton Std., Windsor Locks, Conn.) p 1-17 (See N71-35267 22-05)

2. EVALUATION OF AN ENERGY ABSORBING CREW SEAT INTEGRATED WITH A ROCKET EXTRACTION SYSTEM R. Carpenter (NASA, Flight Res. Center) p 19-34 refs (See N71-35268 22-05)

3. THE FLASH EVAPORATOR FOR TRANSIENT HEAT LOADS J. L. Gaddie (Vought Missiles and Space Co., Dallas, Tex.) p 35-65 (See N71-35269 22-33)

4. RECENT RESULTS FROM ZERO 'G' CARGO HANDLING STUDIES G. P. Beasley (NASA, Langley Res. Center) p 67-82 (See N71-35270 22-05)

5. SUBSYSTEM TRADE-OFF ENVIRONMENTAL CONTROL AND LIFE SUPPORT FOR ORBITER PHASE B CONTRACTOR J. Jasin (McDonnell-Douglas, St. Louis, Mo.) and R. Augusti (Hamilton Std., Windsor Locks, Conn.) p 83-95 (See N71-35271 22-05)

6. PRELIMINARY RESULTS OF SPACE SHUTTLE EC/LSS STUDIES L. G. Clark and R. S. Osborne (NASA, Langley Res. Center) p 97-121 (See N71-35272 22-05)

7. DEVELOPMENT OF A BLADDERLESS TANK FOR SPACE SHUTTLE C. Feindler (Grumman Aerospace Corp.) p 123-155 (See N71-35273 22-05)

N71-35267*# North American Rockwell Corp., Downey, Calif. Space Div.
SPACE SHUTTLE ORBITER ENVIRONMENTAL CONTROL AND LIFE SUPPORT SYSTEMS
O. T. Stoll and A. O. Brouillet (Hamilton Standard, Windsor Locks, Conn.) *In* NASA. Kennedy Space Center Space Shuttle Technol. Conf., Vol. 2 3 May 1971 p 1-17 refs (See N71-35266 22-05)
Avail: NTIS CSCL 06K

The space shuttle orbiter environmental control and life support system is presented. The rationale leading to selection of concepts is stressed. Concept trades were based on an anticipated 1977 initial orbiter flight, ten years operation, and a baseline mission support requirement of four men for seven days. The system must provide the following functions: (1) shirtsleeve environment for the crew and passenger compartment; (2) food, water, oxygen, storage and disposal of trash and human waste; and (3) where required, provide environmental control of equipment in and outside the crew compartment. The system can be refurbished and maintained using airline maintenance concepts, and state-of-the-art concepts will be used and a system will be provided at costs below previous space vehicle systems. Author

N71-35268*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.
EVALUATION OF AN ENERGY ABSORBING CREW SEAT INTEGRATED WITH A ROCKET EXTRACTION SYSTEM
Richard Carpenter *In its* Space Shuttle Technol. Conf., Vol. 2 3 May 1971 p 19-34 refs (See N71-35266 22-05)
Avail: NTIS CSCL 06K

Consideration has been given to equipping the scaled prototype shuttle vehicle with a lightweight energy absorbing seat integrated with a crew extraction rocket. Such a system would provide protection for low velocity vehicle impacts and also offer a means of escape during higher velocity conditions. This system has been developed and fabricated at the Flight Research Center. The energy absorbing seat has been tested in a dynamic impact laboratory with satisfactory results. The escape system has been evaluated by extracting dummies by tractor rockets from a typical cockpit configuration. These tests indicate unsatisfactory performance during high roll rates. Author

N71-35269*# Vought Missiles and Space Co., Dallas, Tex.
THE FLASH EVAPORATOR FOR TRANSIENT HEAT LOADS c33
J. L. Gaddie *In* NASA. Kennedy Space Center Space Shuttle Technol. Conf., Vol. 2 3 May 1971 p 35-65 (See N71-35266 22-05)
Avail: NTIS CSCL 06K

The feasibility of developing a liquid spray flash evaporator for thermal control in the space shuttle was investigated. Results indicated: (1) high efficiency capability; (2) operation without active back pressure control; (3) control by supply rate modulation for heat load transients; (4) capability to assume dormant operation with instant reactivation; and (5) operation with multiple evaporants in a single device. A.L.

N71-35270*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
RECENT RESULTS FROM ZERO g CARGO HANDLING STUDIES
Gary P. Beasley *In its* Space Shuttle Technol. Conf., Vol. 2 3 May 1971 p 67-82 (See N71-35266 22-05)
Avail: NTIS CSCL 22C

Water immersion simulation techniques were used to determine the limits of manual cargo handling and transfer under weightlessness conditions. Package masses from 3 to 50 slugs, volume of 1.5 to 142 cubic feet, moments of inertia up 900 slug sq ft, and various other aspects such as maneuvering aid, pressure suit effects and one-man versus two-man transfers were considered. Preliminary results obtained indicated that manual cargo transfer, in an IVA mode, can be easily accomplished for packages of 50 slugs or more. This appears to preclude the requirement for automated systems for cargo transfer. However, considerations of practical limitations related to the shuttle configuration and time constraints are necessary before final decision is made. A.L.

N71-35271*# McDonnell-Douglas Co., St. Louis, Mo.
SUBSYSTEM TRADE-OFF ENVIRONMENTAL CONTROL AND LIFE SUPPORT FOR ORBITER PHASE B CONTRACTOR
John Jasin and Ronald Augusti (Hamilton Standard, Windsor Locks, Conn.) *In* NASA. Kennedy Space Center Space Shuttle Technol. Conf., Vol. 2 3 May 1971 p 83-95 (See N71-35266 22-05)
Avail: NTIS CSCL 06K

The environmental control and life support (ECLS) subsystem in the orbiter provides a habitable environment for crew and equipment in the hostility of space. The ECLS must provide for the functions of: (1) shirtsleeve environment; (2) water management; (3) atmosphere gas supply; (4) atmosphere revitalization; (5) waste management; and (6) equipment thermal control. The ECLS is active during the mission phases of launch, ascent, on-orbit, entry and landing, and supports two pilots and two cargo handlers. Ground support equipment is utilized during prelaunch, launch, and post landing activity. The four man capacity allows for a wide latitude of mission capability ranging from seven days to thirty days. ECLS extended mission capability is achieved by the addition of modular equipment that is the same as the equipment provided in the orbiter. Provisions for this equipment addition are provided in the initial subsystem design. Author

N71-35272*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
PRELIMINARY RESULTS OF SPACE SHUTTLE EC/LSS STUDIES
Lenwood G. Clark and Robert S. Osborne *In its* Space Shuttle Technol. Conf., Vol. 2 3 May 1971 p 97-121 (See N71-35266 22-05)
Avail: NTIS CSCL 06K

The overall status of the Langley Research Center program on space shuttle environmental control and life support systems is presented, along with preliminary results of studies being conducted and assessments of technology advancements required. Author

N71-35273*# Grumman Aerospace Corp., Bethpage, N.Y.
DEVELOPMENT OF A BLADDERLESS TANK FOR SPACE SHUTTLE
Clauss Feindler *In* NASA. Kennedy Space Center Space Shuttle Technol. Conf., Vol. 2 3 May 1971 p 123-155 (See N71-35266 22-05)
Avail: NTIS CSCL 06K

Results of studies and present state of development of bellows-type tanks for long-term storage of potable water for space shuttles are summarized. Investigations revealed that: (1) mixed cultures and waste waters represent a valid microbiological challenge; (2) steam is effective in sterilizing during launch preparations and after system failure; (3) frequent withdrawals do not affect tank sterility if proper protocol adhered to; (4) sterility can be retained for 100-day periods which are sufficient for shuttle, Skylab 2, and space station applications; (5) tank is suitable for both use by crew onboard launch vehicle and delivery to orbit as part of resupply mission; (6) no adverse odor, taste, or coloration effects noted; (7) volume metering by means of a linear potentiometer is both simple and accurate; (8) design and operation superior to bladder tank in all respects except weight effectiveness; and (9) tank considered as an acceptable development risk for the space shuttle. A.L.

N71-35274# Japan Atomic Energy Research Inst., Tokyo.
CHARACTERISTICS OF PERSONAL MONITORING DOSIMETER
Tatsuo Nishi, Tamizo Motizuki, and Yoshinobu Ashikagaya Jan. 1971 65 p refs In JAPANESE; ENGLISH summary
(JAERI-Memo-4292) Avail: AEC Depository Libraries

Characteristics of personal monitoring dosimeters to estimate external exposure doses are described. Dosimeters described include: film badges; pocket dosimeters and alarm meters; film ring and finger dosimeters; glass dosimeters; thermoluminescence dosimeters; and emergency dosimeters.
Author (NSA)

N71-35275# Federal Aviation Administration, Oklahoma City, Okla. Civil Aeromedical Inst.
ALCOHOL AND DISORIENTATION-RELATED RESPONSES. 4: EFFECTS OF DIFFERENT ALCOHOL DOSAGES AND DISPLAY ILLUMINATION ON TRACKING PERFORMANCE DURING VESTIBULAR STIMULATION
Richard D. Gilson (Naval Aerospace Med. Inst.), David J. Schroeder, William E. Collins, and Frederick E. Guedry (Naval Aerospace Med. Inst.) Jul. 1971 13 p refs
(FAA-AM-71-34) Avail: NTIS

The effects of alcohol on the ability of men to suppress vestibular nystagmus while visually fixating on a cockpit instrument, thus degrading visual tracking performance (eye-hand coordination) during angular acceleration are discussed. Reduced display illumination, independently, has also been shown to degrade tracking performance during vestibular stimulation. The way in which low and moderate dosages of alcohol and two levels of instrument-display illumination combined to affect tracking performance in a static (on motion) environment, and in a dynamic (whole-body motion) environment is presented. Mean blood alcohol levels as low as .027 per cent significantly decreased tracking performance during whole-body motion, yet caused little change in performance in a stationary environment. Impairment was much more pronounced with dim display lighting than with bright lighting. These results suggest that serious problems may be encountered by the pilot who drinks even lightly and who considers flying, especially at night. Author

N71-35276# Bureau of Mines, Pittsburgh, Pa.
INVESTIGATION OF PULSATION DAMPERS FOR PERSONAL RESPIRABLE DUST SAMPLERS
J. A. Lamonica and H. N. Treaftis Aug. 1971 16 p refs
(BM-RI-7545) Avail: NTIS

A pulsation damping device designed to smooth pulsating flow in personal respirable dust samplers was evaluated. The effect on the pulsation dampener efficiency of six parameters was investigated, including volume, diaphragm elasticity, diaphragm area, center orifice area, inlet-outlet orifice area, and geometry (L/D ratio). The results indicate that volume

predominates in determining snubber efficiency, while the other parameters become important at small volumes. Geometry has no effect on snubber efficiency. Criteria for an efficient pulsation dampener construction were obtained. Author

N71-35277# Naval Medical Field Research Lab., Camp Lejeune, N.C.
DEVELOPMENT OF THE NMFRL TELEMETRY SYSTEM, VOLUME 21, NO. 11 Interim Report
Philip J. Rasch Jun. 1971 15 p refs
(AD-726406; NMFRL-Vol-21-No-11; NAVMED-MF12.524.007-IR-3) Avail: NTIS CSCL 06/2

The program involves efforts to convert the Naval Medical Field Research Laboratory's prototype telemetry equipment to a low-duty cycle tone burst system. A proprietary modulated by a series of 700 Hz tone bursts originating from especially designed equipment provided the best telemetered data yet recorded in this series of studies. It is recommended that further studies be conducted using monolithic and hybrid fabricated electronic circuits. GRA

N71-35278# School of Aerospace Medicine, Brooks AFB, Tex.
EVALUATION OF PHOTOCHROMIC GOGGLE SYSTEM FOR NUCLEAR FLASH PROTECTION Final Report, Dec. 1970 - Mar. 1971
William R. Thursby, Jr., Everett O. Richey, Roger V. Bartholomew, and Robert W. Ebers Jun. 1971 49 p
(AD-726544; SAM-TR-71-20) Avail: NTIS CSCL 06/17

The EG and G SY-116 A photochromic goggle system was evaluated to delineate any problem areas associated with it before Category III testing. The following features are presented and discussed: (1) physical characteristics of the goggle, such as closure time and peak optical density; (2) effect of the goggle upon the basic visual functions, such as visual acuity and color vision; (3) aircrew ability to visually detect various targets through the goggle; (4) comparative flashblindness recovery times for both operative and inoperative goggle situations under day and night conditions, utilizing FOT simulator systems; and (5) protection afforded by the goggle from various nuclear environments in terms of safe separation distances. Author (GRA)

N71-35279# Human Factors Research, Inc., Santa Barbara, Calif.
OPERATOR TARGET DETECTION PERFORMANCE AS A FUNCTION OF THE NUMBER OF SONAR ECHOES, INTERVAL BETWEEN TRANSMISSIONS, AND SIGNAL-TO-NOISE RATIO
Charles Abrams, William Dooberian, Selena K. Kerr, and Donald N. Buckner Jun. 1971 18 p refs
(Contract N00014-70-C-0186)
(AD-726741; TR-1700-1) Avail: NTIS CSCL 05/10

A major goal of designers of active sonar systems is to obtain longer target detection ranges. One consequence of longer ranges is longer time intervals between transmissions. Another is lower signal-to-noise ratios and thus fewer transmissions that produce perceptible echoes from a target. The purpose of the study was to investigate the effects of these variables on operator target detection performance. The results indicated the desirability of history or memory type displays with long-range sonar systems to enhance operator detection performance. Author (GRA)

N71-35280# Air Force Human Resources Lab., Williams AFB, Ariz. Flying Training Div.
AIRBORNE AUDIO-VIDEO RECORDING DESIGN CONSIDERATIONS
Milton E. Wood and William V. Hagin Nov. 1970 20 p
(AD-727025; AFHRL-TR-70-33) Avail: NTIS CSCL 14/3

A brief summary of recent airborne audio-video recording research is presented. Based on this research, and recent Air Training Command requirements for an operational airborne audio-video recording system, discussion is presented which considers the several design goals which are involved in the design of any airborne audio-video recording system. Further, an engineering development philosophy is provided which weighs current requirements against various aspects of the state of the art in audio-video technology. Author (GRA)

N71-36204*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
A PROPOSED INCIPIENT FIRE AND TOXIC GAS CAUTION AND WARNING FOR SHUTTLE
A. C. Krupnick *In its* Space Shuttle Technol. Conf., Vol. 1 3 May 1971 p 261-276 (See N71-36192 22-31)
Avail: NTIS CSCL 06K

N71-36208*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
FIRE PROTECTION DESIGN FOR SHUTTLE
G. F. Ard *In its* Space Shuttle Technol. Conf., Vol. 1 3 May 1971 p 277-284 (See N71-36192 22-31)
Avail: NTIS CSCL 06K

06 CHEMISTRY

Includes chemical analysis and identification (e.g., spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants.

N71-36281*# United Aircraft Corp., East Hartford, Conn. Research Labs.
STUDY OF HYDRAZINE REACTOR VACUUM START CHARACTERISTICS Annual Progress Report, 1 Feb. 1970 - 31 Jan. 1971
J. J. Sangiovanni and A. S. Kesten Feb. 1971 26 p refs
(Contract NAS7-696)
(NASA-CR-121904; UARL-K910970-12; Apr-2) Avail: NTIS CSCL 07D

Ignition delays and subsequent chamber pressure excursions in hydrazine catalytic reactors had been ascribed to liquid hydrazine wetting the outside surfaces of the porous catalyst particles and wicking into the pores by capillary flow until sufficient gas pressure is generated by reaction to expel the liquid. In an attempt to provide quantitative measurements of this phenomena, experiments were conducted using high speed motion picture techniques to determine liquid hydrazine residence times as a function of the absorbed gas condition of the catalyst and the liquid hydrazine/catalyst temperature. Nitrogen and carbon dioxide were found to have little or no effect on catalyst activity while hydrogen and ammonia were found to have effects which varied significantly with the gas conditioning pressure and with temperature. The implication of these observations is that ignition delays in hydrazine catalytic reactors are influenced by the reactor operating history, particularly the shutdown transient, as well as by the liquid hydrazine feed temperature. Author

N71-36282*# Techwren Corp., Glen Burnie, Md.
THE QUESTION OF THE MECHANISM OF PHOTOCHEMICAL SYNTHESIS OF AMINO ACIDS UNDER UV-IRRADIATION OF FORMALDEHYDE AND AMMONIA SALT SOLUTION [K VOPROSU O MEKHANIZME FOTOKHIMICHESKOG O SINTEZA AMINOKISLOT PRI DEYSTVII UF-LUCHEI NA RASTVORY FORMAL'DEGIDA I AMMONIYNYKH SOLEY]
B. A. Niskanen et al Washington NASA Sep. 1971 12 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Ser. Biol. (USSR), no. 2, 1971 p 238-245
(Contract NASw-2037)
(NASA-TT-F-13797) Avail: NTIS CSCL 07B

Experimental data show that the initial stage of the mechanism of alpha-amino acid synthesis in UV-irradiated formaldehyde and ammonium nitrate solutions is represented by the formation of formyl radicals-CHO. Successive transformation of formyl radicals leads to the formation of glyoxal which is known to be a highly reactive dialdehyde. The possibility of the formation of glycine from glyoxal and alanine from methylglyoxal when kept in aqueous solutions together with ammonium salts was shown. The significance of the mechanism of alpha-amino acid synthesis for the abiogenic amino acid synthesis during the prebiological period of the earth's history is discussed. Author

N71-35283*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
RADIOLYSIS OF WATER IN SEALED ALUMINUM CAPSULES: ITS PREDICTION AND INHIBITION
Dean W. Sheibley 1971 13 p refs Presented at Am. Nucl. Soc. Meeting, Miami, Fla., 17-21 Oct. 1971
(NASA-TM-X-67899; E-6465) Avail: NTIS CSCL 07D

The results are presented of an investigation into methods of inhubiting the radiolysis of water in sealed aluminum capsules in the Plum Brook Reactor of NASA. Experimental design techniques are employed to identify the measured effects of eight variables and their interactions which control water decomposition and the resultant pressure buildup. Multiple regression analyses are used to develop predictive models for the pressure rise observed in an inpile capsule system. Predictive equations are derived for pressure rise due to the radiolysis of water with air as a cover gas or with helium cover gas containing air as an impurity or mixtures of hydrogen, oxygen, and nitrogen as impurities. Radiation induced reaction products of nitrogen and oxygen are identified as the key to radiolysis behavior. The prevention of radiolysis depends on the exclusion of air or mixtures of nitrogen and oxygen from the system. Pure inert gases, helium, neon, and argon prove to be satisfactory radiolysis inhibitors. This is demonstrated for helium by inpile tests lasting up to 14 days (one reactor cycle)in the Plum Brook Reactor. Author

N71-35284*+ Beckman Instruments, Inc., Fullerton, Calif.
IODINE COLORIMETER, ADDENDUM Final Report
31 Aug. 1971 5 p
(Contract NAS9-11879)
(NASA-CR-115155; FR-1090-900) Avail: NTIS CSCL 07C

The effect of foreign substances in the Skylab water supply on the performance of the iodine colorimeter was evaluated. Spectroscopic analyses were performed on the standard aqueous iodine after the addition of 10 parts-per-million of several metal salts. Ten metal salts were used, each with iodine, and scanned against the iodine, only, solution. The results indicate that none of the chemicals would cause an ambiguous readout with the colorimeter. D.L.G.

N71-35285# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
ANALYSIS OF AIR PULSER PERFORMANCE FOR PULSED EXTRACTION COLUMNS
J. D. Keser Feb. 1971 19 p refs
(Contract AT(45-1)-1830)
(BNWL-B-51) Avail: NTIS

An expression was derived for determining the pulse amplitude in air pulsed columns as a function of reservoir air pressure and pulse frequency. Amplitudes calculated by this expression and by V. L. Hammond's simplified equation compare favorably with experimentally measured amplitudes and with amplitudes calculated by a lengthy numerical procedure. Plots of amplitude versus reservoir air pressure were calculated at several pulse frequencies for two-pulse column designs. Author (NSA)

N71-35286# Baylor Univ., Waco, Tex.
THE RADIATION CHEMISTRY OF HIGH POLYMERS Progress Report, 1 Jun. 1970 - 31 Mar. 1971
Malcolm Dole and Robert A. Welch 1 Apr. 1971 8 p
(Contract AT(40-1)-4059)
(ORO-4059-1; PR-1) Avail: NTIS

Development of computer techniques for data reduction, alkyl to allyl radical conversion in irradiated polyethylene, solubility of hydrogen in polyethylene, free radical decay in irradiated polyoxymethylene, and ESR spectra of irradiated polyoxymethylene are reported. Author (NSA)

N71-35287# Georgia Univ., Athens. Dept. of Chemistry.
THE RADIOLYSIS OF WATER IN A WIDE RANGE RADIOLYSIS SOURCE Progress Report, 1 Sep. 1970 - 1 Jun. 1971
Charles E. Melton 1 Jun. 1971 39 p refs
(Contract AT(40-1)-3729)
(ORO-3729-4) Avail: NTIS

The mechanism involved in the radiolysis of water was under investigation. The problem was approached from both an experimental and a theoretical point of view. The experimental approach involved the design and construction of two research mass spectrometers. Following initial testing of the instruments, attention was focused on the initial excitation processes occurring in the radiolysis of water. For negative species, ionizing radiation produces only three primary products, H(-), O(-) and OH(-). The OH(-) species is produced only with high-energy radiation. Low-energy beta particles (electrons) produce only H(-) and O(-) from water vapor. Cross sections, appearance potentials, and ionization efficiency curves were measured as a function of the energy of the ionizing medium. The resonance capture processes do not produce OH(-) ions as a primary product. Only two negatively charged primary products, H(-) and O(-), were studied to completely characterize the role of negative ions in the overall reaction. Author (NSA)

N71-35288# Goodyear Atomic Corp., Piketon, Ohio.
VAPOR PRESSURE-TEMPERATURE DATA FOR SELECTED HALOGEN-CONTAINING SUBSTANCES
A. J. Saraceno and C. D. Willis 10 Feb. 1971 104 p refs
(Contract AT(33-2)-1)
(GAT-649) Avail: NTIS

Vapor pressure-temperature tables are presented for selected halogen compounds and other substances of interest to those working with uranium processing operations. The tables were prepared by computer printout of calculations based on vapor pressure-temperature equations either taken directly from the literature or derived by least squares fit of vapor pressure (P)-temperature (T) data available in the literature. Each of the 58 substances given in the original listing has its vapor pressure in millimeters of mercury (mm Hg) tabulated as a function of temperature in degrees Kelvin (K) in increments of one degree. NSA

N71-35289# Bureau of Mines, Albany, Oreg.
THE FREE ENERGY OF FORMATION OF INDIUM OXIDE BY EMF MEASUREMENTS
S. C. Schaefer 1971 13 p refs
(BM-RI-7549) Avail: NTIS

Thermodynamic properties of indium oxide were studied with a high-temperature galvanic cell employing stabilized zirconia electrolytes. In the temperature range of 790 to 1230 K the free-energy change for the indium cuprous oxide cell reaction together with the standard free energy of formation of cuprous oxide gives the standard free energy of formation of indium oxide from the elements as -218.78 + 0.07534 T + or - 0.7 kcal/mole. A third-law analysis yields the standard enthalpy of formation as -221.5 kcal/mole. Author

N71-35290# Bureau of Mines, Albany, Oreg.
THERMODYNAMIC PROPERTIES OF FOUR CRYSTALLINE SODIUM BORATES
L. B. Pankratz and M. J. Ferrante 1971 11 p refs
(BM-RI-7551) Avail: NTIS

Enthalpies above 298 K were investigated for four crystalline sodium borates by copper-block drop calorimetry. Determinations were made to 1200 K for NaBO2, 1003 K for Na2B4O7, 1005 K for NaB3O5, and 1046 K for Na2B8O13. No phase transitions or other thermal anomalies were found. The enthalpy determinations, when combined with known heats of formation at 298 K and other supplementary data, enabled the calculation of the heats and free energies of formation of the compounds to their melting points. Values of relative enthalpies, entropies, heat capacities, free energy functions, enthalpies of formation, free energies of formation, and equilibrium constants of formation were tabulated at even temperatures. Author

N71-35291# Research Inst. of National Defence, Stockholm (Sweden).
ON THE SEPARATION AND DETERMINATION OF FLUORINE. 2: DETERMINATION OF 2 - 7 MICROMOLE FLUORINE BY MEANS OF WILLARD-WINTER DISTILLATION AND SPECTROPHOTOMETRIC ANALYSIS [OM SEPARATION OCH BESTAEMNING AV FLUOR. 2: BESTAEMNING AV 2-7 MIKROMOL FLUOR GENOM WILLARD-WINTER-DESTILLATION OCH SPEKTROFOTOMETRISK ANALYS]
L-H. Anderson and B. Gelin Feb. 1970 19 p refs In SWEDISH
(FOA-4-C-4416-24) Avail: NTIS

In connection with an investigation into methods of fluorine determination, studies were made of separation of small amounts of fluorine (2 - 7 micromole), by means of Willard-Winter distillation as well as determination of fluorine in the receptacle by means of spectrophotometric methods. Special attention was paid to precision. When using a distillation apparatus of quartz glass with perchloric acid for cleansing (by means of distillation in the quartz apparatus), a determination was obtained of 2 to 7 micromole fluorine with a standard deviation for separate determination of 0.06 micromole. The average value of the exchange became 99.5 + or - 0.5%. In the analysis of samples containing plutonium (5 micromole fluorine per sample), a precision was achieved of about 0.04 micromole. Author

N71-35292# Research Inst. of National Defence, Stockholm (Sweden).
ON THE SEPARATION AND DETERMINATION OF FLUORINE. 5: DETERMINATION OF 0.5 - 7 MICROMOLE FLUORINE (AND 0.3 - 4 MICROMOLE CHLORINE) IN PLUTONIUM METAL BY MEANS OF PYROHYDROLYSIS AND SPECTROPHOTOMETRIC ANALYSIS [OM SEPARATION OCH BESTAEMNING AV FLUOR. V: BESTAEMING AV 0.5 - 7 MIKROMOL FLUOR (OCH 0.3 - 4 MIKROMOL KLOR) I PLUTONIUMMETALL GENOM PYROHYDROLYS OCH SPEKTROFOTOMETRISK ANALYS]
L-H. Anderson and B Gelin Jan. 1970 9 p refs In SWEDISH
(FOA-4-C-4407-24) Avail: NTIS

A method for the determination of 0.5-7 micromole fluorine (and 0.3-4 micromole chlorine) in plutonium metal by means of pyrohydrolytic separation and spectrophotometric analysis is discussed. It also describes an apparatus for pyrohydrolytic separation. Author

N71-35293# Royal Aircraft Establishment, Farnborough (England).
MECHANISM OF THE POLAROGRAPHIC REDUCTION OF NITRAZEPAM [MECHANISMUS DER POLAROGRAPHISCHEN REDUKTION DES NITRAZEPAMS]
H. Oelschlager et al May 1971 9 p refs Transl. into ENGLISH from Arch. Pharm. (Weinheim), v. 302, no. 4, 1969 p 241-247
(RAE-Lib-Trans-1588) Avail: NTIS

Nitrazepam was reduced at the dropping mercury electrode in two steps with different wave-heights depending on the pH values of the buffer solutions. With the help of a potentiostat, the mechanism of the polarographic reduction was investigated. The electrolytic processes were controlled polarographically. In acid buffers, the nitro group from Nitrazepam is reduced first to the hydroxylamine group, and, at a more negative potential, the reduction of the hydroxylamine group and the azomethine group (4,5) follows in one additive wave. In alkaline buffers, the second wave-height is half of the first wave-height. The NHOH group is not reduced due to insufficient protonation; only the azomethine group is reduced. Author

N71-35294*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
OUTGASSING TESTS ON A MICROWAVE OVEN AND SELECTED FREEZE-DRIED FOODS COOKED IN THE OVEN
Lenora B. Wells and David C. Grana Washington Sep. 1971 12 p refs
(NASA-TM-X-2360; L-7834) Avail: NTIS CSCL 07D

A series of tests was performed to determine the outgassing characteristics of a microwave oven and of a variety of freeze-dried foods cooked in the oven. The tests were conducted in a vacuum chamber at a pressure of 10 psia to simulate a potential spacecraft atmosphere. The main contaminants from the microwave oven were n-butanol, i-butanol, and hexane. Only one food, chicken chunks, produced a sufficient concentration of volatile products for positive identification. These products were hexanal and methyl formate. Author

N71-35295# Lehigh Univ., Bethlehem, Pa.
POLYMER STABILIZATION OF NONAQUEOUS DISPERSIONS
Peter J. Achorn (Ph.D. Thesis) 1970 132 p refs
Avail: NTIS

Two different dispersion media were examined for adsorption behavior and for dispersion stability which could be attributed to entropic repulsion. In an investigation of dispersions in heptane-dehydroabietic acid media, it was found that the adsorption behavior of DHA was similar to the adsorption of fatty acids from hydrocarbons on similar substrates. No dispersion stability was found with DHA. It was concluded that larger adsorbed molecules would be required to stabilize those dispersions by entropic repulsion. Dispersions of alumina, carbon black, and Graphon in polystyrene-cyclohexane media were investigated. None of the very dilute dispersions in the media showed any long term stability despite the presence of polymer and some electrical charges. Polymer entropic repulsion theory predicted a slow flocculation rate many orders of magnitude less than what was found experimentally. The disparity between the theory and the experiments was attributed to the failure of the theory to take into account the enthalpy of mixing polymer segments with solvents. D.L.G.

N71-35296# Stevens Inst. of Tech., Hoboken, N.J. Dept. of Chemistry and Chemical Engineering.
THE QUASI-STATIONARY STATE APPROXIMATION IN POLYMERIZATION KINETICS
J. A. Biesenger and R. Capinpin Jun. 1971 39 p refs Submitted for publication
(Contract N00014-68-A-0131)
(AD-726398; TR-29) Avail: NTIS CSCL 07/4

The errors incurred in free-radical chain addition polymerizations through the use of the popular quasi-stationary state approximation (QSSA) under severe, but fairly common, reaction conditions are examined in detail and simple, useful criteria for applicability of the QSSA are proposed. The conditions examined are 'dead-end' polymerization, polymerization with hindered termination and non-isothermal polymerization. It is concluded that the proposed criteria are reasonably accurate and that in most known free-radical polymerizations only hindered termination might possibly lead to appreciable errors through application of the QSSA. Author (GRA)

N71-35297# Aerospace Corp., El Segundo, Calif. Lab. Operations
METHODS OF CALCULATION OF MOLAR AND PARTIAL MOLAR PROPERTIES FROM DATA FOR ONE COMPONENT AND FROM CONDENSED PHASE EQUILIBRIA
N. A. Gokcen 15 May 1971 24 p refs
(Contract F04701-70-C-0059)
(AD-726536; TR-0059(6210-10)-02; SAMSO-TR-71-116) Avail: NTIS CSCL 07/4

Equations have been derived for calculating the excess thermodynamic properties of multicomponent systems either from the data on one component or from the heterogeneous condensed phase equilibria. This procedure eliminates the need for existing methods of cumbersome graphical integration for the Gibbs-Duhem equations. Author (GRA)

N71-35298# Aerospace Corp., El Segundo, Calif. Lab. Operations.
ORIENTATION DEPENDENCE IN TRIPLET-TRIPLET ENERGY TRANSFER ANALYSIS OF MAGNETOPHOTOSELECTION EXPERIMENTS
Henry S. Judeikis and Seymour Siegel 15 Jun. 1971 33 p refs
(Contract F04701-70-C-0059)
(AD-726563; SAMSO-TR-71-134) Avail: NTIS CSCL 07/4

The authors have examined theoretically and experimentally triplet-triplet energy transfer for several different donor-acceptor pairs dissolved in low-temperature glasses in order to determine if there is some observable preferred mutual orientation for energy transfer, especially at large intermolecular distances. In particular, they have analyzed experiments that used magnetophotoselection techniques. The results substantially support earlier findings that indicated the absence of observable orientation effects. In analyzing our experiments, it was found that for any given system a large fraction of the donor molecules will transfer efficiently and will exhibit little in the way of orientation effects unless delta-function-type orientation dependences exist. Even at low acceptor concentrations, these molecules represent a significant portion of all molecules that transfer, and their presence will tend to minimize experimentally observable effects. Author (GRA)

N71-35299# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Physics.
LOW TEMPERATURE SPECIFIC HEAT OF NI(NO3)2-6H2O; ANTIFERROMAGNETIC INTERACTIONS
A. Herweijer and S. A. Friedberg 1 Jul. 1971 17 p refs
(Contract N00014-67-A-0314-0006)
(AD-726429; TR-5) Avail: NTIS CSCL 20/12

Measurements of the specific heat of nickel nitrate hexahydrate for 0.5 < T < 12K reveal a Schottky anomaly with C sub p max = 1.373 cal/mole-K at T sub max = 2.35K. The experimental data are explained by the complete splitting of the S = 1 ground state triplet, with levels separated successively by 4.80K and 3.26K. The lattice contribution is found to be 0.000411 x T(3) cal/mole-K. The discrepancies between the level spacings as deduced from these measurements and from the reported powder susceptibility data are removed by taking into account a small antiferromagnetic exchange interaction (A/K = +0.6K) in a molecular field approximation. The total magnetic entropy change is found to be within 0.6% of the theoretically predicted value, R1n3, for a spin 1 system. Author

N71-35300# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
THE ABSOLUTE OSCILLATOR STRENGTHS OF THE PB I LINES LAMBDA 2833, LAMBDA 2873, LAMBDA 3639, LAMBDA 3683 AND LAMBDA 4057 BY THE METHOD OF TOTAL ABSORPTION
William F. Grof (M.S. Thesis) Jun. 1971 54 p refs
(AD-726987; GEP/PH/71-9) Avail: NTIS CSCL 07/4

The oscillator strengths of PB I for Lambda 2833, Lambda 2873, Lambda 3639, Lambda 4057 were measured by the method of total absorption. Radiation was passed through lead vapor of a known temperature. A 6-meter spectrograph was used to photograph the absorption lines. This data along with lead vapor pressure data yielded the f-values. The f-values found agreed well with those found by other laboratories. Due to systematic errors, there was a 10% uncertainty in the average f-values of each line. The standard deviation of the 16 samples of each line was less than 10%. Author (GRA)

N71-35301 National Lending Library for Science and Technology, Boston Spa (England).
GAS CHROMATOGRAPHIC ESTIMATIONS OF WATER
G. M. Neuman 2 Mar. 1971 8 p refs Transl. into ENGLISH from Z. Anal. Chem. (Berlin), v. 244, 1969 p 302-305
(NLL-M-20374-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

Methods for the determination of trace amounts of water are discussed, and the utilization of Poropak as a column material for quantitative analysis of trace water by adsorption gas chromatography is described. The detection limit for quantitative analysis, without prior concentration, is 150 ppm for gases and 1 ppm for liquids. Author

N71-35302 National Lending Library for Science and Technology, Boston Spa (England).
OXIDATION OF NICKEL IN ATMOSPHERE WITH DIFFERENT CONTENTS OF SULPHUROUS GAS
V. N. Konev 17 Mar. 1971 6 p refs Transl. into ENGLISH from Zashch. Metallov (USSR), v. 6, 1970 p 448-450 In RUSSIAN and ENGLISH
(NLL-LTI-746-718-(9022.401); LTI-737-9765) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The effects of temperature and atmospheric sulfur content on the oxidation of nickel are considered. The nickel oxide scales and growth mechanisms are described and the mechanism of sulfur diffusion across the oxide scale is discussed. J.M.

N71-35303 National Lending Library for Science and Technology, Boston Spa (England).
PECULIARITIES OF HIGH TEMPERATURE OXIDATION OF NICKEL AND NI-M OXIDE COMPOSITES
O. A. Peshkova et al 17 Mar. 1971 6 p refs Transl. into ENGLISH from Zashch. Metally (USSR), v. 6, no. 5, 1970 p 591-593 In RUSSIAN and ENGLISH
(NLL-Trans-746-754-(9022.401); LTI-737-10123) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The oxidation rate of pure nickel and its composites was measured with ThO2, ZrO2, HfO2, TiO2, and A1203 oxide in air in a temperature range of 800 to 1200 C. The method of periodic suspension without extraction of the sample from the reaction zone of the furnace was applied. The oxidation duration was from one to six hours. On the dependence curves of the oxidation rate of the materials investigated on temperature, a break at 1000 C for nickel and 900 C for its composites with oxides is observed. The observed break is linked with the different mechanisms of the growth of scale under these conditions. Author

N71-35642# Joint Publications Research Service, Washington, D.C.
INVESTIGATION OF REDUCTION OF NIOBIUM PENTOXIDE BY LAMPBLACK
V. A. Nikolayeva *In its* Mater. for MHD Generator Channel 31 Aug. 1971 p 183-190 refs (See N71-35621 22-18)
Avail: NTIS

07 COMMUNICATIONS

Includes communications equipment and techniques; noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation.

N71-35304*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A HISTORY OF THE DEEP SPACE NETWORK FROM INCEPTION TO 1 JANUARY 1969
N. A. Renzetti, (ed.) 1 Sep. 1971 96 p refs
(Contract NAS7-100)
(NASA-CR-121898; JPL-TR-32-1533) Avail: NTIS CSCL 17B

The Deep Space Network is a precision communications system designed to communicate with and control unmanned spacecraft in the exploration of deep space. The DSN utilizes large antennas, low-noise phase-lock receiving systems, and high-power transmitters located at stations positioned approximately 120 deg around the Earth. A special world-wide communications system connects these stations to the DSN mission control center in Pasdena, California. It is the policy of the DSN to continuously conduct research and development of new systems, components, and techniques and to incorporate them into the DSN to maintain a state-of-the-art capability. This history relates the development and results of this policy through January 1, 1969. Author

N71-35305*# Illinois Univ., Urbana. Biological Computer Lab.
PULSE INTERVAL REPRESENTATIONS OF SPEECH EVENTS
John William Atwood 15 Oct. 1970 71 p refs
(Grants NGR-14-005-111; AF-AFOSR-1865-70)
(NASA-CR-12189; tr-22; NASA-4; UILU-ENG-70-294) Avail: NTIS CSCL 17B

The analysis, synthesis, and transmission of human speech is approached by a technique which is based on the computation of time intervals between threshold transitions of the derivative in the speech waveform. The position taken here is that the sequence in which significant speech events occur, and their temporal relationships to each other, are for the description of speech as important as its frequency-domain properties, and that the dynamic properties and the sustained properties of the speech waveform each contribute to our understanding of human speech. In particular, it is shown that this coding method provides a basis for transmitting speech with high intelligibility at low transmission rates; permits the measurement of many properties of the speech waveform which are difficult or impossible to evaluate using conventional techniques; and allows synthesis, by rule, of many speech sounds. Author

N71-35306*# Washington Univ., St. Louis, Mo.
PROGRAM ON APPLICATION OF COMMUNICATION SATELLITES TO EDUCATIONAL DEVELOPMENT. COMMUNICATION MEDIA AND EDUCATIONAL TECHNOLOGY: AN OVERVIEW AND ASSESSMENT WITH REFERENCE TO COMMUNICATION SATELLITES
Herbert Ohlman May 1971 232 p refs
(Grant NGL-26-008-054)
(NASA-CR-122037; Rept-T-71/1) Avail: NTIS CSCL 17B

A survey and analysis are presented of the state of the art and future trends of communication media and educational technology. Particular emphasis is placed upon the potential uses of communication satellites to help meet the future needs of education in the United States, and upon the substitution of electronic transmission for physical distribution of educational materials. A multipurpose educational satellite service is proposed, based on supplementing conventional instructional television programs with the electronic transmission of a variety of materials, using such television-compatible media as still-picture television, computer-assisted instruction, and facsimile. Author

N71-35307*# Washington Univ., St. Louis, Mo.
PROGRAM ON APPLICATION OF COMMUNICATIONS SATELLITES TO EDUCATIONAL DEVELOPMENT. STILL-PICTURE TELEVISION (SPTV) TRANSMISSION
Gulab Sharma May 1971 90 p refs
(Grant NGL-26-008-054)
(NASA-CR-122042; Rept-T-71/2) Avail: NTIS CSCL 17B

Multichannel, continuous-audio still-video, television transmission systems are categorized and described for producing a diversity of program material in a limited frequency spectrum, such as a satellite transmission system. The system parameters and constraints are identified. The number of still picture channels that can be realized in a limited spectrum, the interrelation of various parameters with system constraints, and general system considerations are explored. Author

N71-35308*# Houston Univ., Tex.
INFLUENCE OF BANDWIDTH RESTRICTION ON THE SIGNAL-TO-NOISE PERFORMANCE OF A MODULATED PCM/NRZ SIGNAL, PART 2 Final Report
N. M. Shehadeh and Kwei Tu 31 Aug. 1971 201 p refs
(Contract NAS9-9270)
(NASA-CR-115160) Avail: NTIS CSCL 17B

The effects of bandlimiting on the performance of various digital transmission systems corrupted by additive white Gaussian noise are analyzed using two methods, the averaging method and the series expansion method. The results from both methods agree. The performance of an ideal bandlimited NRZ (non-return-to-zero) baseband transmission system is examined using correlation detection and sampling. The explicit expression for the degradation of the signal and the intersymbol interference as a function of system parameters is derived. The average, lower bounds and upper bounds of the probabilities of bit-error are computed for both detectors. It is shown that the correlation detector performs better than the sample detector for BT > 0.6 and worse for BT = 0.5. A split-phase baseband system is also analyzed following the same steps used for analyzing the NRZ system. It is shown that a Split-Phase baseband system requires less than twice as much bandwidth as the NRZ system to have the same probability of bit-error for the same value of signal-to-noise ratio using the correlation detector. Author

N71-35309*# TRW Systems Group, Houston, Tex. Communications and Sensor Systems Dept.
SPACE COMMUNICATION SYSTEM SPECIFICATION AND PERFORMANCE CRITERIA STUDY
J. C. Miller 2 Sep. 1971 104 p refs
(Contract NAS9-8166)
(NASA-CR-115156; TRW-17618-H203-R0-00) Avail: NTIS CSCL 17B

The development of a new communication system for advanced spacecraft was studied to provide manufacturers with adequate performance criteria, standardized test configurations, and calibration material to prevent expensive and time consuming changes and retrofits. Topics discussed include voice intelligibility criteria, evaluating television pictures, digital system criteria, and criteria test mechanization. It is concluded that: (1) The use of the articulation index is a valid performance criterion in voice communication. (2) Picture quality evaluation is subjective and is not as easily defined as word intelligibility. (3) The average bit error rate is the standard criteria for uncoded systems. F. O. S.

N71-35310# National Oceanic and Atmospheric Administration, Boulder, Colo.
EFFECTS OF POLAR CAP ABSORPTION EVENTS ON GEOSTATIONARY SATELLITE VHF COMMUNICATIONS SYSTEMS
J. H. Pope and H. Leinbach Nov. 1970 40 p refs

(NOAA-TR-ERL-196-OD-5) Avail: SOD $0.50

Different models of incident particle flux were assumed in order to compute the amount of absorption and its geographical extent. The amount of absorption to be expected was computed at several different frequencies, including the VHF frequency at 137 MHz. Calculations were made assuming various values for particle cutoff energies. This parameter was in turn used to define the geographical boundaries of the polar cap region. Having thus obtained models for polar cap absorption, computations were made taking into consideration the angle of the ray to the satellite and the position at which the ray intersects the absorbing region. The results were used to obtain contours of oblique 137 MHz absorption relative to 30 MHz polar cap absorption. It is shown that, depending on latitude and other factors, the oblique 137 MHz absorption may be about 0.5 of the polar cap vertical absorption at 30 MHz. As the latter sometimes reaches values in excess of 20 dB, the former at times exceeds 10 dB. Data from past PCA events were analyzed statistically to obtain a number of factors of importance to communications systems. Author

N71-35311# Research Inst. of National Defence, Stockholm (Sweden).

CCIRS INTERIM MEETINGS FOR STUDY GROUPS 5 AND 6 AT GENEVA 1969 AND THE STUDY OF INVESTIGATIONS INTO WAVE PROPAGATION BY FTZ IN DARMSTADT [CCIRS INTERIMSMOETEN FOER STUDY GROUPS 5 OCH 6 I GENEVE 1969 SAMT STUDIUM AV VAGUTBREDNINGSFORSKNING VID FTZ I DARMSTADT DARMSTADT]

Ake Blomquist and Rune Lindquist Jan. 1970 35 p refs In SWEDISH

(FOA-3-A-3730-60) Avail: NTIS

The characteristics of radio wave propagation in the troposphere, ionosphere, and along the surface of the earth are discussed. Activities in the field of wave propagation are presented. Information based on European study group findings forms the basis for the report. Author

N71-35312# Research Inst. of National Defence, Stockholm (Sweden).

A SLOWLY FADING GAUSSIAN INFORMATION CHANNEL [EN LANGSAMT FAEDANDE GAUSSISK INFORMATIONSKANAL]

Thomas Ericson Jan. 1970 19 p refs In SWEDISH

(FOA-3-A-3735-63) Avail: NTIS

A nonmathematical analysis of a slowly fading Gaussian information channel are presented. Results are based on an information study of the effect of fading in a Gaussian channel under different assumptions concerning receiver's capability to estimate the momentary signal value. Author

N71-35313# Research Inst. of National Defence, Stockholm (Sweden).

THE POINT TRACKER: A CONTRAST FOLLOWER USING TELEVISION TECHNIQUE [PUNKTFOELJAREN: EN KONTRAST FOELJARE MED TELEVISIONS TEKNIK]

Sten Ahlbom and Sture Hannson Feb. 1970 15 p refs In SWEDISH

(FOA-2-C-2370-52) Avail: NTIS

An automatic contrast follower, based on a combination of conventional television techniques and digital circuit techniques has been devised and built. The follower is generally intended for use when a contrast's position relative to a shift in a fixed point, is to be represented by a signal. Examples of applications are measurement of an aircraft when landing and an angle measurement instrument in a process regulator system and the like. Author

N71-35314# Research Inst. of National Defence, Stockholm (Sweden).

THE STUDY OF FREQUENCY CORRELATION IN TROPOSPHERIC PROPAGATION [STUDIUM AV FREKVENSKORRELATION VID TROPOSFAERSPRIDING]

L. Jonasson and Hans Eriksson Oct. 1969 9 p In SWEDISH; ENGLISH summary

(FOA-3-C-3606-63) Avail: NTIS

A measurement of the correlation coefficient between different frequency components in a communication link at about 1000 MHz over a range of 259 km is reviewed. The frequency separation between the different components was 1 MHz. The measurements show unexpectedly low values for the correlation. Author

N71-35315# Air Force Cambridge Research Labs., Bedford, Mass.

FREQUENCY VARIATIONS OF AN OBLIQUE 5 MHz IONOSPHERIC TRANSMISSION

Kurt Tomen 21 Apr. 1971 18 p refs

(AD-726528; AFCRL-71-0253; AFCRL-ERP-353) Avail: NTIS CSCL 20/14

The 5-MHz WWV-transmission originating on the east coast of the United States at Beltsville, Maryland was received 604 km from the transmitter at Air Force Cambridge Research Laboratories, Bedford, Massachusetts. At the receiving end narrow filters were employed to separate the carrier frequency from the upper-side-band frequencies. The 5 MHz carrier frequency was heterodyned to 500 kHz and compared with a 500 kHz reference signal of an oscillator whose frequency stability was about 1 part in 10 to the 9th power. The diurnal frequency variation of the 5 MHz ionospheric signal was obtained for days selected from the year 1965. Optimum frequency stability was observed near noon. For 24 March 1965 the diurnal behavior of the 600 Hz modulation phase was obtained. Virtual height data from an ionosonde station located near the midpoint of the path were compared with Doppler frequency variations. Author (GRA)

N71-35316# Ohio State Univ., Columbus. Electroscience Lab.

MEASUREMENT AND ANALYSIS OF SPECTRAL SIGNATURES Final Technical Report, 24 Feb. 1970 - 24 Feb. 1971

Jun. 1971 95 p refs

(Contract F30602-69-C-0231)

(AD-726640; ESL-2784-2; RADC-TR-71-114) Avail: NTIS CSCL 17/9

An experimental and analytical study of a particular time-domain signature for radar space object identification is described. Measured data presented for several simple metallic shapes which demonstrate the direct relationships between the physical properties of a radar target and its time-domain signature are presented. Valid time-domain signature waveforms obtained by combining three-frequency low resonance scattering data and short pulse radar data are also presented. Finally, a new, approximate technique for producing a three dimensional target image from time-domain signature data at three look angles is described and illustrated with computer-drawn isometric views of simple shapes. Author (GRA)

N71-35317# Applied Psychological Services, Wayne, Pa. Science Center.

SUMMARY OF HUMAN FACTORS IN SUPPORT OF SONAR SYSTEM DEVELOPMENT Final Report, 15 Sep. 1967 - 15 Jul. 1971

Arthur I. Siegel Jul. 1971 31 p refs

(Contract N00014-68-C-0104)

(AD-726711; Rept-7172-1) Avail: NTIS CSCL 17/1

The report is presented in two parts. The first part summarizes the sonar system oriented human factors work. Part 2 contains an outline which can provide a basis for a sonar specific manual of human factors considerations in sonar system design, development, and test. Author (GRA)

N71-36318# Institute for Telecommunication Sciences, Boulder, Colo.
ATTENUATION CALCULATIONS FOR A TWO-LAYER EARTH-CRUST WAVEGUIDE FOR SUB-SURFACE ELECTROMAGNETIC PROPAGATION
Kenneth P. Spies and James R. Wait 17 Jun. 1971 16 p refs (NAonr-15-17)
(AD-726754; TR-2) Avail: NTIS CSCL 20/14

New calculations for the mode characteristics for an idealized model of the earth crust waveguide have been carried out. Specifically, the authors have considered a homogeneous waveguide region bounded below by a homogeneous transition layer whose conductivity is intermediate between that of the main waveguide region and the bottom conductive region. A numerical supplement (if not included here) is available from the authors. It is shown that the presence of the transition layer usually increases the attenuation rate of the dominant modes although there are some interesting exceptions. Author (GRA)

N71-36319 National Lending Library for Science and Technology, Boston Spa (England).
THE CADUCEE PROJECT
A. Jouseet 1 Jun. 1971 13 p Transl. into ENGLISH from l'Echo des Recherches (France), no. 60, Apr. 1970 p 10-17
(NLL-PORS-Trans-2712-(9022.81)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

The Caducee project proposes within a short period of time to open a switched network reserved solely for the users of teleprocessing information systems. The need for the network is based on an analysis of present French telecommunication system and estimates of future requirements. The network structure, switching equipment, and transmission link characteristics are described. J.G.M.

N71-36320 New Mexico Univ., Albuquerque.
INPUT IMPEDANCE AND RADIATION PATTERN OF RECTANGULAR CAVITY BACKED APERTURE ANTENNAS IN REENTRY ENVIRONMENT
David Leslie Wright (Ph.D. Thesis) 1969 213 p
Avail: Univ. Microfilms Order No. 70-17294

An experimental antenna was built and tested and results of both experiments and theory for both input impedance and radiation pattern are presented. Input impedance was treated to allow any arbitrary but finite number of modes to interact with the probe, permitting very shallow cavities and/or cavities operated at frequencies such that higher order modes may propagate. The primary limitation was a thin wire assumption which was investigated and discussed in detail. The input impedance expression is a variational expression employing a two term current distribution on the input probe. Comparisons of one and two term values for input impedance are included and discussed. Dissert. Abstr.

N71-36263*# Communications Satellite Corp., Washington, D.C.
NASTRAN-GAP: AN INTEGRATED APPROACH TO THE ANALYSIS OF RADIATION PATTERNS OF DISTORTED REFLECTORS
William L. Cook *in* NASA. Langley Res. Center NASTRAN: Users Experiences Sep. 1971 p 141-161 refs (See N71-36253 22-32)
Avail: NTIS HC $9.00/MF $0.95 CSCL 20N

08 COMPUTERS

Includes computer operation and programming; and data processing. For applications, see specific categories. For related information see also: 19 Mathematics

N71-36321*# IIT Research Inst., Chicago, Ill. Engineering Mechanics Div.
SOFTWARE INTERFACING OF FLIGHT DATA Final Report, 9 Jun. 1970 - 9 Jun. 1971
M. R. Phillips Jul. 1971 70 p
(Contract NAS8-26209)
(NASA-CR-61380) Avail: NTIS CSCL 09B

The problem of handling and processing nonsystems flight data storage tapes of vast amounts of data from various installations is considered. This requires interfacing and data conditioning capabilities and, in some instances, data compression capabilities. These data compression capabilities reflect the characteristics of the physical data in smaller quantities, such as mean values, correlation functions, spectral density functions, and probability density functions. Flight data received thus far were taken from a multispectral scanner, and have been interfaced to the Marshall Space Flight Center computers. Numerous data sets have been processed, and several algorithms have been checked out using the flight data. The software developed to interface and condition nonsystems raw data tapes was designed to be used also on the UNIVAC 1108 EXS by modifying the data translation portion only. This software was developed using very modular techniques which provides immediate inclusion of other nonsystems formatted tapes. The flow diagram shows the input/output, data conditioning, and in general, the data flow. Author

N71-36322*# Notre Dame Univ., Ind. Dept. of Electrical Engineering.
CONVOLUTIONAL CODING TECHNIQUES FOR DATA PROTECTION Final Report, 16 Sep. 1969 - 15 Sep. 1970
9 Aug. 1971 11 p refs
(Grant NGL-15-004-026)
(NASA-CR-121917) Avail: NTIS CSCL 09D

Contributions to the theory of convolutional codes, sequential decoding, sub-baud coding, and inverse systems in data protection are presented. A list of publications on the subject is included. Author

N71-36323*# TRW Systems Group, Houston, Tex.
INVESTIGATION OF DATA COMPRESSION TECHNIQUES Final Report
15 Sep. 1971 108 p refs
(Contract NAS9-10876)
(NASA-CR-115177; TRW-16158-H019-R0-00) Avail: NTIS CSCL 09B

Actual electrocardiographic data was applied to various data compression/reconstruction algorithms to determine how accurately these data could be reconstructed and with what data compression magnitudes. A candidate algorithm population was established and selection processes resulted in the application of electrocardiographic data from twenty individual subject/test conditions to the fast Fourier and fast Hadamard transforms; parallel adaptive composite; cycle-to-cycle with a filter; and a new fast Fourier cycle-to-cycle redundancy reduction algorithm. This study concluded that real electrocardiographic data can be compressed/reconstructed with statistical inaccuracies in the order of one-half to five percent. Further, the parallel adaptive composite algorithm was concluded to be the most desirable algorithm studied from the standpoints of accuracy, bandwidth compression ratio, software and computer requirements. Author

N71-36324*# DBA Systems, Inc., Melbourne, Fla.
DOCUMENTATION OF PHOTOGRAMMETRIC MISSION SIMULATOR PROGRAM. VOLUME 2: GLOBAL BLOCK ADJUSTMENT MODULE Final Technical Report
Aug. 1971 90 p refs
(Contract NAS9-10256)
(NASA-CR-115172) Avail: NTIS CSCL 09B

The Simulated Photography Submodule generates a file of simulated plate measurement data. Input to the submodule is described. Output from the submodule is a file containing one record per simulated photography. This file is called the Unsorted

Working Data File. The records are in order of increasing photo numbers. The photo numbers themselves are chosen in a manner which minimizes the bandwidth of the normal equations, formed in the second submodule. Author

N71-35325*# California Univ., Los Angeles. School of Engineering and Applied Science
NASAP-70 USER'S AND PROGRAMMER'S MANUAL
Howard Okrent and Lawrence P. McNamee Oct. 1970 354 p refs
(Contract NAS12-2138)
(NASA-CR-121933; UCLA-ENG-7044) Avail: NTIS CSCL 09B

A detailed description of NASAP-70, a digital circuit analysis program, is presented along with the system requirements, program listing, and dictionary of variables. The program was written completely in FORTRAN 4. Because of its unique characteristics and the modular manner in which the program is constructed, algorithms can easily be mechanized, changed, and expanded for digital computation. The fundamentals of setting up a problem for NASAP-70 are given, and the theory behind the program is discussed. In addition, the most popular transistor models in use today are described and a discourse of environmental effects on transistor models is included. D.L.G.

N71-35326*# Stanford Univ., Calif.
RESEARCH ON INSTRUCTIONAL STRATEGIES FOR OPTIMIZING THE LEARNING PROCESS Final Report
30 Jun. 1971 70 p refs
(Grant NGR-05-020-244)
(NASA-cr-121936) Avail: NTIS CSCL 09B

The application of theoretical models of instructional strategies to the design and implementation of a computer-controlled instructional system and to the development of a practical course of instruction in computer programming is considered. Author

N71-35327# Houston Univ., Tex. Dept. of Industrial and Systems Engineering
GRAID: A GRAPHICAL AID COMPUTER LANGUAGE
Charles E. Donaghey and Osman S. Ozkul Mar. 1971 111 p
(Contract N00014-68-A-0151; Project THEMIS)
(AD-722027; RE-1-71) Avail: NTIS CSCL 09/2

Usually there are a variety of sophisticated plot programs available for computer users in every installation. However, for a novice user who might want to quickly see a plot of his data the use of these programs can become cumbersome because of the rigid requirements in preparation of the data and in the use of the package. For this reason GRAID (graphical aid) has been developed which allows a user to input, generate, manipulate and display his data quickly and easily. The rules of the language have been kept to a minimum and as close to the conventional ways and human habits as possible. The language answers the needs of a moderate range of users with a minimum amount of time invested in learning. Author (GRA)

N71-35328# Joint Publications Research Service, Washington, D.C.
ELEMENT RECOGNITION IN CONTINUOUS SPEECH COMPOSED OF WORDS FROM A GIVEN DICTIONARY
T. K. Vintsyuk 2 Sep. 1971 19 p refs Transl. into ENGLISH from Kibernetika (Kiev), no. 2, 1971 p 133-143
(JPRS-53975) Avail: NTIS

A method of solution for the problem of recognizing continuous, uninterrupted speech composed of words from an arbitrary but known dictionary is discussed. A procedure for recognizing continuous speech is proposed such that, out of all the possible methods for dividing the speech signal into words, the one is chosen that guarantees the best, in a certain sense, recognition result. This is achieved by using the computer procedure of dynamic programming, which determines the recognition process when the results of dividing the signal into words are repeatedly corrected. Author

N71-35329# National Physical Lab., Teddington (England). Div. of Computer Science.
A PROGRAM TO ALLOW COMPUTER BASE HISTORY: TAKING IN CASES OF SUSPECTED GASTRIC ULCER
C. R. Evans and J. H. Wilson May 1971 24 p refs
(NPL-Com-Sci-49) Avail: NTIS

A flow diagram, illustrating the logic of automated history-taking in cases of suspected gastric ulcer, and a detailed printout of the program itself are presented. ESRO

N71-35330# National Physical Lab., Teddington (England). Div. of Computer Science.
AUTOMATIC ERROR CORRECTION IN NATURAL TEXTS, PART 1
A. J. Szanser May 1971 41 p refs
(NPL-Com-Sci-48) Avail: NTIS

A method for automatic error correction in natural text, elastic matching, processed by computer is investigated, developed technically, and completed by other procedures. The minimum length of a word to which it was applicable was established at four letters. ESRO

N71-35331# Research Inst. of National Defence, Stockholm (Sweden).
CAVY: A COMPUTER PROGRAM FOR DESIGNING RADIAL MICROWAVE CAVITIES. [CAVY, DATAMASKIN-PROGRAM FOER UTFORMNING AV RADIELLA MIKROV-AGSKAVITETER]
Peter Lundborg Mar. 1970 20 p refs In SWEDISH
(FOA-2-C-2378-51) Avail: NTIS

The computer program CAVY is described. The program is intended for use in the design of microwave cavities for electro-optical applications. Starting from fundamental field equations the resonance equation is derived which gives the size of cavity for a given frequency. The report also provides information on how input data should be written and how the output data is presented. Finally, a review of some of the results obtained during test runs of the program, is given. Author

N71-35332# Research Inst. of National Defence, Stockholm (Sweden).
SIXTH SYMPOSIUM ON REMOTE SENSING [SJAETTE SYMPOSIET OM REMOTE SENSING I ANN ARBOR DEN 13-16 OKTOBER 1969]
Erik Fagerlund, Mats Forsell, and Harald Svensson Jan. 1970 35 p In SWEDISH Conf. held at Ann Arbor, Mich., 13-16 Oct. 1969
(FOA-2-C-2386-52) Avail: NTIS

The proceedings of a symposium on remote sensors are presented. The use of remote sensing techniques in the field of scientific geological applications is discussed. Different techniques, apparatus, and systems for collecting and processing data are described. Author

N71-35333# Research Inst. of National Defence, Stockholm (Sweden).
A COURSE ON DIGITAL PICTURE PROCESSING AT THE UNIVERSITY OF MARYLAND FROM 5 TO 9 JANUARY 1970, TOGETHER WITH TWO STUDY VISITS TO INSTITUTIONS INVESTIGATING THIS SUBJECT [RAPPORT FRAN EN KURS I DIGITAL BILDBEARBETNING VID UNIVERSITAT OF MARYLAND UNDER TIDEN 5-9 JANUARI 1970 SAMT TVA STUDIEBESOEK VID INSTITUTIONER SOM FORSKAR PA OMRADET]
J-O. Eklundh Feb. 1970 8 p refs In SWEDISH
(FOA-2-C-2369-52) Avail: NTIS

Developments in the field of picture processing by computer are discussed. The system described is based on digital techniques. A survey of a university course and the activities of two organizations concerned with this subject are presented. Author

N71-36334# Research Inst. of National Defence, Stockholm (Sweden).
INFORMATION THEORY AND ITS TECHNICAL APPLICATIONS FOR COMMUNICATION [INFORMATIONSTEORIN OCH DESS KOMMUNIKATIONSTEKNISKA TILLAEMPNINGAR]
Thomas Ericson Jan. 1970 18 p refs In SWEDISH
(FOA-3-A-3733-63) Avail: NTIS

A shortened presentation is given in nonmathematical form of information and coding theories. A survey of the state of the art (1969) of these sciences is also given together with an attempt at a forecast. Finally some points of view are submitted dealing with the theory's relation to practical problems. Author

N71-36335# Research Inst. of National Defence, Stockholm (Sweden).
STUDY OF INFORMATION CHANNELS WITH AND WITHOUT CHANNEL MODELS [STUDIUM AV INFORMATIONSKANALER MED OCH UTAN KANALMODELLER]
Kjell Jonsson Oct. 1969 31 p refs In SWEDISH, ENGLISH summary
(FOA-3-C-3610-63) Avail: NTIS

Examples are given of how information channels and their use are studied by means of mathematical channel models and data simulation. In conclusion, a suggestion for an application of channel study for FOA 3 is given. Author

N71-36336*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
HETRAN: A COMPUTER PROGRAM TO SOLVE THE TWO-DIMENSIONAL STEADY-STATE HEAT CONDUCTION ON A CLADDED TUBE WITH A CONNECTING FIN
Frank B. Motts Washington Sep. 1971 56 p refs
(NASA-TM-X-2351; E-6351) Avail: NTIS CSCL 20M

The computer program, was written in FORTRAN 4, version 13, for the IBM 7094/7044 DCS to solve the two-dimensional equation, with convective boundary conditions on a cladded tube with a connecting fin. The tube wall, cladding, and fin can be made of different materials. The required input consists of an initial guess to the solution, the parameters defining the region, the heat transfer coefficients on the bounderies, the coolant and gas temperatures, and the relaxation parameters. Temperature dependent thermal conductivity is handled by a user supplied subroutine. Author

N71-36337# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.
A RADIX-2 FAST FOURIER TRANSFORM PROGRAM
Harry Maynard Mar. 1971 39 p refs
(AD-726389; ECOM-5363) Avail: NTIS CSCL 09/2

A computer program has been prepared to implement the fast Fourier transform algorithm for a radix-2 transform, i.e., the number of points in the transform must be a power of 2. The program has been prepared as a subroutine and is written in the FORTRAN language for a CDC 6000 series computer. An additional subroutine which facilitates the transformation of real data has also been prepared. Author (GRA)

N71-36338# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
ARTIFICIAL INTELLIGENCE AND LARGE INTERACTIVE MAN COMPUTER SYSTEMS Annual Report Apr. 1970 - Apr. 1971
Jaime R. Carbonell 12 Jul. 1971 26 p refs
(Contract N00014-70-C-0264)
(AD-726441) Avail: NTIS CSCL 09/2

The paper reports on SCHOLAR, the first prototype system capable of a true mixed-initiative man-computer dialogue on a given topic. The computer is not only capable of answering questions from the man (both using a comfortable and not too restricted subset of English), but also of generating questions, analyzing the man's responses, and producing reasonable consequent actions. All this occurs without full anticipation of conversational items and sequences. A very powerful program, applicable to many subject matters, acts upon a highly structured data base to generate the computer answers and questions, to evaluate the man's answers, and to produce suitable action sequences. The paper discusses recent additions such as an improved inference making capability, more flexible handling of natural language, and a new sophisticated graphic capability. Author (GRA)

N71-36339# Lincoln Lab., Mass. Inst. of Tech., Lexington.
DEANE: A COMPUTER AID FOR BALLISTIC MISSILE DEFENSE ANALYSIS
Douglas L. McCraith 4 Nov. 1970 75 p
(Contract F19628-70-C-0230)
(AD-727045; ESD-TR-70-339; TN-1970-6) Avail: NTIS CSCL 09/2

DEANE is a special-purpose computer language designed for use in a time-shared environment by a ballistic missile defense systems analyst. In essence, it is a sophisticated calculator whose modular design allows the user to request basic computations in a convenient fashion. The interpretation of the computational results is not made by DEANE under the pretense of being a simulator, but is left to the user. This report is a user's manual describing the computations available and giving examples of how they may be ordered to solve typical problems. Also presented is a description of the logical and/or mathematical foundations of the computations. Author (GRA)

N71-36340 National Lending Library for Science and Technology, Boston Spa (England).
SPECIALIZED DIGITAL COMPUTER WORKING ON STRAIGHT-LINE-CIRCULAR INTERPOLATION FOR USE IN DIRECT PROGRAMMED CONTROL OF MILLING MACHINES [SPETSIALIZIROVANNAYA TSIFROVAYA MASHINA RABOTAYUSHCHAYA PO PRINTSIPU LINEINO-KRUGO-VOI INTERPOLATSII, PREDNAZNACHENNAYA DLYA NEAREGYVNOGO PROGRAMMNOGO UPRAVLENIYA FREZERNYKH STANKOV]
E. Kachinski May 1971 32 p Transl. into ENGLISH from Proc. of IFAC Symp., Budapest, Apr. 1968 p 99-103
(NLL-RTS-6307) Avail: Natl. Lending Library, Boston Spa, Engl.: £3.00 or 10 NLL photocopy coupons; SIS $10.80

A special purpose digital computer using straight line circular interpolation for the continuous program control of milling machines is described. The following problems are discussed: method of interpolation, means for path correction, the principles of programming, the technical realization of the system, and technical specifications. Author

N71-36284*# Boeing Co., Renton, Wash.
DATA MANAGEMENT REQUIREMENTS FOR LARGE PROBLEMS
Stanley D. Hansen and Harold B. Hanstean *In* NASA. Langley Res. Center NASTRAN: Users Experiences Sep. 1971 p 533-550 (See N71-36253 22-32)
Avail: NTIS HC $9.00/MF $0.95 CSCL 09B

N71-36286*# National Aeronautics and Space Administration, Washington, D.C.
NASA TECHNOLOGY TRANSFER: THE COMPUTER SOFTWARE DISSEMINATION PROGRAM
Joseph M. Carlson *In its* NASTRAN: Users Experiences Sep. 1971 p 551-562 (See N71-36253 22-32)
Avail: NTIS HC $9.00/MF $0.95 CSCL 09B

N71-36288*# General Dynamics/Convair, San Diego, Calif.
NASTRAN EXPERIENCES OF FORT WORTH OPERATION, CONVAIR AEROSPACE DIVISION OF GENERAL DYNAMICS
Merle Allen *In* NASA. Langley Res. Center NASTRAN: Users

Experiences Sep. 1971 p 553-558 (See N71-36253 22-32)
Avail: NTIS HC $9.00/MF $0.95 CSCL 09B

N71-36287*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A SPECIAL NASTRAN PROGRAM FOR INPUT CHECKING AND UNDEFORMED STRUCTURE PLOTTING
Williamna W. Smith *In its* NASTRAN: Users Experiences Sep. 1971 p 559-568 (See N71-36253 22-32)
Avail: NTIS HC $9.00/MF $0.95 CSCL 09B

N71-36291*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SAVINGS IN NASTRAN DECOMPOSITION TIME BY SEQUENCING TO REDUCE ACTIVE COLUMNS
R. Levy and S. Wall *In* NASA. Langley Res. Center NASTRAN: Users Experiences Sep. 1971 p 627-631 refs (See N71-36253 22-32)
(Contract NAS7-100)
Avail: NTIS HC $9.00/MF $0.95 CSCL 09B

N71-36292*# Naval Ship Research and Development Center, Washington, D.C.
NEW ELEMENT DEFINITION CAPABILITY FOR NASTRAN
Myles M. Hurwitz and Michael E. Golden *In* NASA. Langley Res. Center NASTRAN: Users Experiences Sep. 1971 p 633-636 (See N71-36253 22-32)
Avail: NTIS HC $9.00/MF $0.95 CSCL 09B

N71-36296*# General Dynamics/Convair, San Diego, Calif.
AN INTERACTIVE COMPUTER GRAPHICS PROGRAM FOR NASTRAN
Michael Cronk *In* NASA. Langely Res. Center NASTRAN: Users Experiences Sep. 1971 p 659-667 (See N71-36253 22-32)
Avail: NTIS HC $9.00/MF $0.95 CSCL 09B

N71-36298*# Boeing Co., Seattle, Wash.
NASTRAN USER INTERFACES: AUTOMATED INPUT INNOVATIONS
Malcolm W. Ice *In* NASA. Langley Res. Center NASTRAN: Users Experiences Sep. 1971 p 669-678 refs (See N71-36253 22-32)
Avail: NTIS HC $9.00/MF $0.95 CSCL 09B

N71-36297*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
PROCEDURE FOR EFFICIENTLY GENERATING, CHECKING, AND DISPLAYING NASTRAN INPUT AND OUTPUT DATA FOR ANALYSIS OF AEROSPACE VEHICLE STRUCTURES
Gary L. Giles and Charles L. Blackburn (Avco Corp., Nashville, Tenn.) *In its* NASTRAN: Users Experiences Sep. 1971 p 679-696 refs (See N71-36253 22-32)
Avail: NTIS HC $9.00/MF $0.95 CSCL 09B

N71-36299*# Computer Sciences Corp., Silver Spring, Md.
NASTRAN PLOTTING CAPABILITIES
John R. McDonough *In* NASA. Langley Res. Center NASTRAN: Users Experiences Sep. 1971 p 709-735 refs (See N71-36253 22-32)
Avail: NTIS HC $9.00/MF $0.95 CSCL 09B

N71-35249# Joint Publications Research Service, Washington, D.C.
GAMES AND THEIR PROGRAMMING
In its The Struct. of Human Thinking Activity 3 Sep. 1971 p 75-109 refs (See N71-35245 22-04)
Avail: NTIS

09 ELECTRONIC EQUIPMENT

Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors; integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation.

N71-35341# Toulouse Univ. (France).
SIMULATION OF AN ELECTRON AVALANCHE IN He USING A MONTE CARLO METHOD [SIMULATION D'UNE AVALANCHE ELECTRONIQUE DANS L'HELIUM PAR UNE METHODE DU TYPE MONTE-CARLO]
Jean-Francois Denes (Ph.D. Thesis) 5 Feb. 1971 115 p refs In FRENCH; ENGLISH summary
(NP-18798) Avail: AEC Depository Libraries

A direct simulation was made of the behavior of electrons in a strong uniform electric field (high E/P values). The results obtained permitted the investigation of the limits to the validity of the classical distribution law for the free paths, the value of the transmission factor, the effect of the initial energy of the electrons, and the cathode reflection coefficient. A study of the mean energy in the vicinity of the equilibrium, other macroscopic coefficients, and the ionization probabilities enabled the growth in electron population accompanying the transient phase of the avalanche to be studied. NSA

N71-35342*# ITT Industrial Labs., Fort Wayne, Ind. Tube and Sensor Labs.
RESEARCH IN THE DEVELOPMENT OF AN IMPROVED MULTIPLIER PHOTOTUBE Final Report, Jul. 1970 - Jul. 1971
H. W. Baker, E. H. Eberhardt, and R. J. Hertel Jul. 1971 63 p refs
(Contract NASw-1855)
(NASA-CR-121913; FR-2) Avail: NTIS CSCL 09A

The performance and response characteristics of a smoothing dissector for low light level astronomy and optical detection are discussed. The theory of the image intensifier image dissector is described, and details are given on the frequency response, S/N ratio, and performance as a spectrum scanner. The use of one or more intensifier tubes ahead of an image dissector offers many advantages. It is felt that use of a dissector with a slit aperture, scanning a low light level spectrum, in the quantum counting mode, may be a valuable technique. A calibrated photoelectron emitter, for low emission density levels, is also described. N.E.N.

N71-35343*# General Electric Co., Schenectady, N.Y. Tube Dept.
DESIGN AND DEVELOPMENT OF A SELF-HEALING FUSE Final Report
N. D. Jones and L. P. Harris 23 Sep. 1970 110 p refs
(Contract NAS12-675)
(NASA-CR-72868) Avail: NTIS CSCL 09A

The mercury-filled self-healing fuses developed afford very good protection from faults for solid-state circuits. Fuse performance and design parameters are characterized. Trends in fuse behavior indicate good durability for devices with very small channels. A series of sample fuses using alumina and sapphire insulation were furnished for circuit evaluation. Fuse ratings are 100 volts, up to 15 amperes. Author

N71-35344*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FABRICATION, SPIN TESTING AND MAGNETIC TESTING OF A WELDED ROTOR IN A 36000 RPM LUNDELL ALTERNATOR
Stacy Lumannick and David W. Medwid Sep. 1971 14 p refs

(NASA-TM-X-67929; E-6594) Avail: NTIS CSCL 09E

A Lundell-type rotor consisting of magnetic and nonmagnetic materials was fabricated by puddle welding Inconel 625 between two sections of AISI 4817 steel. The finish-machined rotor which has a major diameter of 3.26 inches (8.28 cm) was spin tested to 50,000 rpm (140% of design). No measurable yield occurred. Test results showing saturation curves for load and no-load conditions with the rotor installed in a 1200-hertz Brayton-cycle research alternator are presented. Author

N71-35348*# Teledyne Kinetics, Solana Beach, Calif.
SEAL STUDY
R. A. Conrad [1971] 73 p
(Contract NAS9-11470)
(NASA-CR-115118) Avail: NTIS CSCL 09A

The design and testing of a high current switch and a multiple contact, low current switch are reported with respect to hermetic sealing switches within an existing configuration. The predesigns and header to housing welding are described. Failures which occurred during the torque test and post vibration, dielectric tests are analyzed. J.M.

N71-35348*# Control Data Corp., East Boston, Mass. Microwave Products Div.
FEASIBILITY STUDY OF A RADIATOR AND POWER DIVIDER FOR 50 - 60 GHz PHASED ARRAY
Kenneth A. Green and George J. Gill 30 Aug. 1971 72 p refs
(Contract NAS12-2273)
(NASA-CR-111949) Avail: NTIS CSCL 09E

For scanning a pencil beam, in one plane only two antenna components are needed: a line source for arraying in the plane of scan and a power divider to feed each radiator's phaser with the desired amplitide distribution. Broadband, low loss designs for these two components were conceived, designed, constructed and tested to demonstrate their feasibility for use in a millimeterwave phased array with high beam efficiency. Most types of E plane line sources are eliminated because their width is greater than the required array element spacing. An H plane sectoral horn for arraying in the E plane is a practical choice because it has the required physical width and bandwidth and can be fabricated for the millimeter region. Author

N71-35347# Commissariat a l'Energie Atomique, Limeil (France). Centre d'Etudes.
USE OF SUPERCONDUCTORS FOR ENERGY STORAGE AND DISCHARGE
J. Sole 1970 14 p In FRENCH Presented at the Panel on Superconductors, Paris, 17-18 Mar. 1970
(CEA-CONF-1736; CONF-700341-5) Avail: AEC Depository Libraries

The various processes connected with energy storage and discharge using superconductors are briefly studied. The processes of charging by external or internal generators, with or without any electric connections, and the associated storage processes are examined as well as the optimized value of the stored energy, the process involved in the transfer of the stored energy into the output circuit by direct connection or inductive coupling, according to the nature of the output circuit. NSA

N71-35349# Nagoya Univ. (Japan). Inst. of Plasma Physics.
EXPERIENCE IN LARGE CAPACITY HIGH VOLTAGE SWITCHES FOR BSG PROJECT
Sunao Kawasaki and Taijiro Uchida Mar. 1970 63 p refs In JAPANESE
(IPPJ-DT-19) Avail: AEC Depository Libraries

High voltage switches with large capacity were designed for the power sources of the BSG system. A throw-in vacuum switch is made of copper-tungsten alloy. Trigger pulse of 15 kV were supplied to the switch by a trigger circuit that received an external signal with 200 volts of pulse height and 5 micro sec duration. The duration time of the trigger pulses was about 60 microns. Conditioning was necessary when this switch was used for voltages of 20 kV or more. Design of a crowbar switch is the same as the throw-in switch except for parallel loads. A throw-in switch with three-point gap in air was designed to improve performance of the crowbar switch and was used under the condition of 40 kV and 100 kA. Parallel operation of in-air or pressurized switches was performed to obtain plasma with several hundred volts. Thirty switches were operated in good condition. A low inductance (large-capacity) crowbar switch (1 nH, 1 MA) was operated with load of 10 nH, being used for theta pinch system. NSA

N71-35349# Carleton Univ., Ottawa (Ontario). Faculty of Engineering.
A STUDY OF DISPERSIVE BEHAVIOUR IN MICROSTRIP TRANSMISSION LINES
O. P. Jain May 1971 109 p refs Sponsored by Dept. of Commun. and Natl. Res. Council of Can.
Avail: NTIS

The apparent variation of the effective dielectric constant of microstrip transmission lines with frequency is studied experimentally, empirically and analytically. The experimental techniques for the measurement of dispersion are described. Empirical relations are derived from the experimental results which describe (within an accuracy of + or - 5%) the dispersive behaviour in microstrip transmission lines for a wide range of dielectric constants, substrate thickness, and w/h ratios. A coupled mode analysis of dispersion in microstrip transmission lines is developed by considering the coupling between the TEM mode and TM surface wave mode. An expression for the coupling coefficient is derived from a series of qualitative arguments and experimental results on dispersion. The analysis accounts for dispersion (within an accuracy of + or - 2%) in microstrip transmission lines for a wide range of microstrip line parameters. Author

N71-35350# Technische Hogeschool, Eindhoven (Netherlands).
HIGH-FREQUENCY PROPERTIES OF A DOUBLE-CATHODE TUBE
Willem Versnel (Ph.D. Thesis) May 1971 114 p refs
Avail: NTIS

The operating characteristics of a double cathode electronic tube are presented. Subjects discussed are: (1) potential distribution, (2) admittance and noise at high frequencies, (3) equations for phase-space densities, (4) integral equations for field strength, and (5) relative impedance of tube mounted in a waveguide. P.N.F.

N71-35351# National Research Council of Canada, Ottawa (Ontario).
SOME ELECTRON-OPTICAL PROPERTIES OF THE POINTED CATHODE [UEBER EINIGE ELEKTRONENOPTISCHE EIGENSCHAFTEN DER SPITZENKATHODE]
S. Maruse et al 1971 10 p refs Transl. into ENGLISH from Optik (Stuttgart), v. 5, no. 8, 1958 p 485-491
(NRC-TT-1473) Avail: NTIS

Some experimental results concerning the optical properties of the pointed cathode are discussed. Particular attention was given to brightness determinations and extending operation times. The use of the pointed cathode as a cold cathode in the electron microscope was considered. It was found that the brightness is about 300 to 1500 times as great as the theoretical maximum value of the hot cathode at the same temperature. Author

N71-35352# Maryland Univ., College Park. Dept. of Physics and Astronomy.
A 300 MEGACYCLE LOGIC WITH MECL, PART 3
W. S. Risk [1970] 37 p refs Sponsored by AEC
(ORO-2504-172-pt-3; TR-71-102) Avail: NTIS

Two high speed logic circuits developed for a high energy physics experiment have easily met or surpassed the performance of the best available commercial logic at a fraction

of commercial costs. A four-fold coincidence-latch circuit and an eight-fold fanout circuit demonstrate that discrete component logic even at the highest attainable speeds is fast approaching obsolescence. The output rise time of the coincidence circuit is 0.8 nanoseconds with a pulse pair resolution of less than three and one third nanoseconds. The output rise time of the fanout is 1.0 nanosecond with a pulse pair resolution of 4 nanoseconds. The circuits are completely D.C. coupled and N.I.M. compatible. The circuits were developed for use with a large, sectioned liquid scintillation detector. Author (NSA)

N71-35353# Research Inst. of National Defence, Stockholm (Sweden).
MEASUREMENTS WITH GUNN DIODES (2) [MAETNINGAR PA GUNN-DIODER (2)]
B. Peterson Jan. 1970 31 p refs In SWEDISH
(FOA-3-A-3734-61) Avail: NTIS

The Mullard diode 106 CXY has been examined. The results of both CW and pulse measurements are reviewed. Different parameters which affect the start of oscillations have been studied. Author

N71-35354# California Univ., Livermore. Lawrence Radiation Lab.
A 12 KILOWATT OUTPUT SWITCHING TYPE POWER AMPLIFIER
Terry L. Rossow 15 Apr. 1971 5 p refs Presented at the 4th Symp. on Eng. Problems of Fusion Res., Washington, 20 Apr. 1971 Sponsored by AEC
(UCRL-73047; Conf-710418-5) Avail: NTIS

High-power-output servoamplifiers using switching devices to control instantaneous output power can provide significant performance and cost advantages over conventional amplifiers. Of special interest is the silicon controlled rectifier when used as a low-cost, high-power switch in such an amplifier. A typical design for this type of amplifier is illustrated. Author (NSA)

N71-35355# Forsvarets Teletekniska Lab., Stockholm (Sweden).
COMPARISON TEST OF STANDARDIZED SEMICONDUCTOR COMPONENTS FROM DIFFERENT MANUFACTURERS. PART 1: SILICON DIODE, 1 AMP [JAEMEOERANDE PROV MED STANDARDISERADE HALVLEDARKOMPONENTTYPER FRAN OLIKA TILLVERKARE]
G. Lundqvist and B. Pilsaeter Nov. 1969 21 p In SWEDISH
(FTL-A-A1010-38) Avail: NTIS

Trial batches of components were subjected to different forms of temperature stresses and electrical loading for the prediction of eventual faults. The results confirmed the predictions of future faults which were derived from an analysis of preliminary electrical measurements. Most of the components examined showed great tolerance to overloads, but the spread within and between different groups was relatively high. The importance of a well prepared purchasing specification is emphasized. Author

N71-35356# Research Inst. of National Defence, Stockholm (Sweden).
TRAVELLING WAVE APPLIFIERS: ACCOUNT OF A VISIT TO USA IN JUNE 1969 [VANDRINGSVAGFOERSTAERKARE - USA. ERFARENHETER FRAN EN RESA I JUNI 1969]
C.-G. Lundqvist Jan. 1970 18 p In SWEDISH
(FOA-3-A-3732-66) Avail: NTIS

The development, production, and characteristics of travelling wave tubes and microwave components used in electronics countermeasures equipment are presented. Interviews and discussions with design personnel are reported. Products manufactured by several U.S. firms are discussed. P.N.F.

N71-35357# Harry Diamond Labs., Washington, D.C.
A COMPUTER-AIDED DATA REDUCTION TECHNIQUE FOR RADIATION-INDUCED CONDUCTIVITY EXPERIMENTS
Harold E. Boesch, Jr. May 1971 33 p refs
(AD-726359; HDL-TR-1545) Avail: NTIS CSCL 09/1

A data analysis approach is described for extracting time-dependent radiation-induced conductivity of a dielectric material from the recorded response of a test circuit. The technique makes possible accurate determination of sample conductivity in time regimes where measurements are perturbed by time constants of the measuring circuit. Several representative test circuits and their conductivity solutions are discussed. The circuit solutions are used in a computer program for the reduction of experimental conductivity data. Author (GRA)

N71-35358# Aerospace Corp., El Segundo, Calif. Lab. Operations.
TOP WALL AND BRANCH WAVEGUIDE HYBRIDS FOR MILLIMETER WAVELENGTHS Final Report, Apr. 1966 - Apr. 1969
Martin F. Bottjer and Howard E. King 15 Apr. 1971 22 p refs
(Contract F04701-70-C-0059)
(AD-726538; TR-0059(6230-20)-2; SAMSO-TR-71-32) Avail: NTIS CSCL 09/1

Top-wall and multiple-branch waveguide couplers were developed as hybrid junctions for millimeter wavelengths, and their electrical characteristics were measured. For construction of the 55-GHz top-wall coupler, electroforming techniques were used; for the 94-GHz branch-guide coupler, the branch lines were cut directly into the wall of the main guide. Copper losses were less than 0.2 d B for the two types of couplers. Author (GRA)

N71-35359# Aerospace Corp., El Segundo, Calif. Plasma Research Lab.
DIFFRACTION COEFFICIENTS FOR A SLOT-EXCITED CONICAL ANTENNA Final Report, Jan. 1970 - Jan. 1971
David C. Pridmore-Brown 15 Apr. 1971 47 p refs
(Contract F04701-70-C-0059)
(AD-726539; TR-0059(6220-10)-7; Samso-TR-71-114) Avail: NTIS CSCL 09/5

First-order diffraction coefficients for a slot-excited conical antenna are calculated, beginning with integral expressions for the radiation field. Simple formulas based on these coefficients are presented for the radiation patterns that correctly reproduce the interference structure, as well as predict the magnitude of the field down to quite low frequencies. Plots of the diffraction coefficients are given for both symmetric and asymmetric excitation of a circumferential slot. Radiation fields are compared with those obtained by summation of the exact normal mode series. Author (GRA)

N71-35360# Air Force Cambridge Research Labs., Bedford, Mass.
POINTING CALIBRATION OF A HIGH-RESOLUTION MILLIMETER-WAVE ANTENNA BY STAR OBSERVATIONS
Melvin Burak 29 Mar. 1971 71 p refs
(AD-726527; AFCRL-71-0220; AFCRL-PSRP-460) Avail: NTIS CSCL 09/5

An extensive pointing calibration program for the drive system and mount of the AFCRL 29-ft millimeter-wave antenna is described. The optical pointing accuracy was determined by measuring the positioning errors of the optical axis of the antenna. Since all sources of optical pointing errors produce equivalent RF errors, all RF errors except those produced by feed system and reflector asymmetry are determined. A brief description of the antenna together with the integrated IBM 1800 data aquisition and control system, tracking software, and an accurate time-synchronization method are presented. The star tracking program, which includes a method of star selection, precession correction, and refraction correction, is described. The analysis and derivation of the various pointing error

parameters used to determine the best-fitting functions that characterize the positional errors are presented. Next, the star data are reduced by fitting the nightly error measurements to the best-fitting error function from which the values of the error parameters that take into account the servo, collimation, azimuth plane tilt, elevation axis skewness, and residual refraction are determined. Finally, the results of the star data analysis and statistical data are presented. The rms residual optical pointing error, after pointing calibration, averaged about 3 percent of the antenna beamwidth, that is, 7.5 arc seconds in both azimuth and elevation. Author (GRA)

N71-35361# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
A STUDY OF SIMULATANEOUS SOLID STATE DIFFUSION IN FABRICATION OF INTEGRATED CIRCUIT FROM DOPED SILICAFILMS
Alan A. Ross (M.S. Thesis) Mar. 1971 71 p refs
(AD-726553; GE/EE/71-24) Avail: NTIS CSCL 09/5

The study explores three areas. The first is the use of doped Silicafilms as diffusion sources. The second is the use of these Silicafilm diffusion sources in simultaneous diffusion of N and P-type regions. The third is the production of complementary insulated gate field effect transistors using Silicafilm diffusion sources in a triple-diffusion process. The doped Silicafilms were shown to be useful diffusion sources. The simultaneous diffusion was not achieved, and the conclusion is that even if simultaneous diffusion is possible using Silicafilm sources, the gain would not be worth the effort. The triple-diffusion process worked well, and the resulting devices are discussed in the last part of the report. Author (GRA)

N71-35362# Rome Air Development Center, Griffiss AFB, N.Y.
CIRCUIT PROPERTIES OF AVALANCHE DIODES
Brian Culshaw (Cornell Univ.) Jun. 1971 70 p refs
(AD-726550; RADC-TR-71-111) Avail: NTIS CSCL 09/1

The report gives an account of a series of experimental and theoretical investigations into the operating characteristics of avalanche diodes in various circuit configurations. The general aim of these investigations is to develop techniques by which a given device may be characterized and its performance under known circumstances reliably ascertained. The topics discussed include a computer model of the device transients, a method of measuring the small signal admittance of an active diode, an attempt at the construction of a simple microstrip oscillator circuit, and some results on the use of the diode as a sub-transit frequency oscillator and amplifier. Author (GRA)

N71-35363# Syracuse Univ. Research Corp., N.Y. Defense Systems Div.
ANTENNA STUDY FOR HF D/F APPLICATION Annual Report, 1 Nov. 1969 - 30 Sep. 1970
Richard G. Russell and Stephen E. Cooper Nov. 1970 248 p refs
(Contract N00014-70-C-0206)
(AD-726400; DSL-R-298) Avail: NTIS CSCL 09/5

A discussion of the theoretical considerations which were necessary in selecting an aperture size is presented. Also included is a system hardware section which covers the receiver and phasemeter tests, and analytical work pertinent to the satelite antenna development. Finally, the initial system testing performed at SURC is discussed and analyzed. Appendices include the software developed, ionospheric records collected during the test, and an errata pertaining to the n-mode wave interference analysis. Author (GRA)

N71-35364# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
HANDBOOK ON THE USE OF RADIO-MEASUREMENT INSTRUMENTS, PART 2
A. I. Tereshin et al 26 Feb. 1971 401 p refs Transl. into ENGLISH of the book "Spravochnik po Ekspluatatsii Radioizmeritelnykh Priborov" Kiev, Izd-vo Tekhnika, 1969 p 1-452
(AD-726585; FTD-MT-24-127-70-Pt-2) Avail: NTIS CSCL 14/2

Contents: Instruments for observation and investigations of frequency-response curve of radio sets (Group X); Measuring amplifiers (Group Y); Instruments for pulsating measurements (Group I); Instruments for measuring the field intensity and radio interferences (Group P); Functional units and modules of the coaxial and the waveguide channels of the measuring devices (Group Z); Measuring generators (Group G); Parameter measuring devices of receiver-amplifiers of low-power electric vacuum and semiconductor instruments (Group L). GRA

N71-35365# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SYNTHESIS OF CIRCUITS FROM UNIVERSAL ELEMENTS
I. Dmitriakova et al 11 Feb. 1971 22 p refs Transl. into ENGLISH from Nauch. Tekh. Inform. Vses. Inst. Nauch. Tekh. Inform. Ser. 1 (Moscow), no. 5, 1969 p 21-24
(AD-726589; FTD-HC-23-848-70) Avail: NTIS CSCL 09/5

The efficiency of application of logical elements realizing a set of Boolean functions is determined, on the one hand, by the rational use of similar elements, and on the other hand, by the necessity of having an adequate set of functions for a more expedient synthesis of functional circuits. The selection of functions used for solving the problems of synthesis is equivalent to the selection of the types of logical elements from which any desirable logical circuit can be constructed. Some specific features of the synthesis of complex circuits made of versatile elements which perform all logical functions of arguments are considered. The application of these elements to constructing logical and computing circuits provides the most economical constructions, but this calls for the application of new principles of optimization of the process of synthesis. It is shown that the efficiency of constructing circuits from versatile multiterminal networks is determined by the peculiarities of synthesis as well as by engineering advantages, low cost and reliability of the resulting circuits. Author (GRA)

N71-35366# Picatinny Arsenal, Dover, N.J.
AN ENGINEERING STUDY COMPARING INSULATION RESISTANCE TO DIELECTRIC STRENGTH TESTING
Richard J. Memico May 1971 45 p refs
(AD-726924; PA-TM-1969) Avail: NTIS CSCL 11/7

The study investigates the differences, simulations, and interrelationships between insulation resistance and dielectric strength testing to determine if either can be eliminated to effect economy in testing. Author (GRA)

N71-35367# Illinois Univ., Urbana. Coordinated Science Lab.
STEADY STATE ANALYSIS OF NONLINEAR CIRCUITS THAT HAVE A PERIODIC RESPONSE
T. J. Aprille, Jr. and T. N. Trick Jun. 1971 34 p refs
(Contract DAAB07-67-C-0199)
(AD-726912; R-515; UILU-ENG-71-2218) Avail: NTIS CSCL 09/5

A very important problem in the computer-aided design of nonlinear circuits is the steady state analysis of lightly damped nonlinear circuits such as harmonic multipliers and oscillators. Presently one searches for the periodic response by simply integrating the system equations from a given initial state until the response becomes periodic. In lightly damped systems this integration could extend over many periods making the computation costly. In this paper a Newton algorithm is defined which converges rapidly to the steady state response. The algorithm is applied to several nonlinear circuits. The results show a considerable reduction in the amount of time necessary to compute the steady state response. In addition, the initial iterates give information on the transient response of the system. Author (GRA)

N71-35368# Radio Corp. of America, Princeton, N.J.
OPTOELECTRONIC ELECTRON EMITTER Semiannual Report, 15 Oct. 1970 - 14 Apr. 1971

Horst Schade, Herbert Nelson, and Henry Kressel Fort Monmouth, N. J. ECOM Jul. 1971 23 p refs
(Contract DAAB07-71-C-0059; ARPA Order 1686)
(AD-726941; ECOM-0059-1) Avail: NTIS CSCL 09/1

An improved optoelectronic cold-cathode emitter structure was developed which is grown completely by liquid-phase epitaxy. The combination of an efficient Al(1-x)GaxAs light-emitting diode and long diffusion length GaAs:Ge layer has yielded a device emitting as much as 3A/sq cm (pulsed) with an overall efficiency of 1.6% (vacuum current/diode current). Continuous operation was obtained at a current density of 0.4 A/sq cm with an efficiency of 0.43%, which was sustained for a period of 8 hr in a dynamic vacuum system. Author (GRA)

N71-35369# Cornell Univ., Ithaca, N.Y. School of Electrical Engineering.
ADVANCED CONCEPTS OF MICROWAVE GENERATION AND CONTROL IN SOLIDS Quarterly Progress Report, 1 Jan. - 31 Mar. 1971
G. C. Dalman, L. F. Eastman, C. A. Lee, and J. H. Frey Griffiss AFB, N. Y. RADC Jun. 1971 184 p refs
(Contract F30602-71-C-0110)
(AD-727058; RADC-TR-71-116; QPR-2) Avail: NTIS CSCL 09/1

The report deals with the progress made during the second quarterly period of a solid state microwave oscillator and amplifier research and development program. Discussed first is the progress on Gunn effect research. Work on the following specific topics is reviewed: high efficiency studies of LSA oscillators; some harmonic properties of an LSA oscillator; LSA circuit studies; operation of multiple LSA diodes; a varactor tuned Gunn oscillator; and a Gunn effect amplifier. The progress made on a parallel program on avalanche diode devices is also described. The following specific topics are reviewed: performance characteristics of subharmonically locked IMPATT diode oscillators; IMPATT efficiency and average power improvement resulting from second harmonic tuning; harmonic properties of avalanche diode oscillators; integrated IMPATT and TRAPATT oscillators; high-efficiency avalanche oscillations; avalanche device calculations in the anomalous high-efficiency regime; higher average power TRAPATT oscillator studies; and measurements of IMPATT diode parameters at microwave frequencies. Finally, the progress made on the studies of solid state materials for microwave devices are reported. The topics include: ion implantation and diffusion; vacuum epitaxial growth in silicon; microwave avalanche oscillator fabrication from bulk material; and epitaxial growth and performance of gallium arsenide. Author (GRA)

N71-35370# Army Test and Evaluation Command, Aberdeen Proving Ground, Md.
PERFORMANCE OF COMMUNICATION-ELECTRONICS EQUIPMENT DURING TRAVEL Final Report
15 Jun. 1971 10 p refs
(AD-726908; MTP-6-3-518) Avail: NTIS CSCL 17/2

The document defines procedures for evaluating the performance of communication-electronics equipment while being transported by man and equipment. Author (GRA)

N71-35371# Air Force Cambridge Research Labs., Bedford, Mass.
THE 120-CELL PUNCHED-CARD MODIFIABLE LOGIC ARRAY
Marvin E. Brooking and Alfred Giusti 26 May 1971 23 p
(AD-726996; AFCRL-71-0316; AFCRL-PSRP-457) Avail: NTIS CSCL 09/2

The 120-cell Punched-card Modifiable Logic Array is a repetitive eight-neighbor array of identical NAND gates that can be organized into different data processing subsystems. The signal interconnections between gates are controlled through punched-card operation; any subset of eight-neighbor connections can be made. This versatile and flexible logic array was fabricated for evaluating and verifying cellular logic concepts that appear to have utility for multipurpose or multifunctional arrays. Such arrays could be used in Air Force signal or data processing systems to enhance their flexibility. The array is described, the mode of interconnection control is outlined, and an example of the implementation of a ring oscillator and binary counter chain is presented. Author (GRA)

N71-35372 National Lending Library for Science and Technology, Boston Spa (England).
COMPUTER SUPPORTED DESIGN FOR A WIDE BAND AMPLIFIER
W. Gutermann 13 Apr. 1971 6 p refs Transl. into ENGLISH from German report NTZ-7, Oct. 1970 p 46-48
(NLL-Trans-2734-(9022.81)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

A procedure used for the computer-aided design of a wide band amplifier is outlined. The amplifier has the function of compensating for line suppression in the frequency range of 4 to 60 MHz, and of balancing temperature induced variations of line suppression and differences of length through corresponding amplification changes by means of a tunable network. The amplifier consists of the active part, the negative feedback network, and both branch repeaters. To establish the design procedure and the specifications for the computer programs, it is necessary to determine the transmission volumes of the overall amplifier and the negative feedback loop as a function of the four-terminal network sizes of the single part-network. Dispersal matrices are employed to obtain these relations. The network to be analyzed is built up from simple elementary networks by chain, serial, and parallel connections by means of multiplying and adding the corresponding matrices, to form a total network. The chain matrix is calculated from the total network and from this the desired transmission volumes, or even further four-terminal matrices, are deduced. D.L.G.

10 ELECTRONICS

Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see specific Physics categories.

N71-35373*# North American Rockwell Corp., Anaheim, Calif.
INVESTIGATION OF MULTILAYER PRINTED CIRCUIT BOARD MATERIALS Final Report
J. E. Meinhard Jun. 1971 86 p refs
(Contract NAS8-21477)
(NASA-CR-119934) Avail: NTIS CSCL 09E

A multilayer board technology utilizing a polyimide plastic as the dielectric and a pyrolyzed polyacrylonitrile as a portion of the conductor network was developed and tested. The polymide, in addition to providing a closer thermal expansion match, even with metallic conductors, proved adaptable to fabrication techniques and superior in stability to physical stresses of all types. The pyrolyzed polyacrylonitrile was selected as the major component of an organic z-direction conductor after screening several classes of promising organic conductive solids. Thin film metallized circuits were employed in the x, y-planes. A set of internally compatible procedures and sequences was developed for the fabrication of electrically functional boards capable of reliable connection to external circuitry. A total of 11 boards were completed, each containing four levels of internal circuitry and one exposed top circuit. Five of the boards were subjected to 427 environmental stress cycles over the temperature range, -55 to +100 deg C, the final 211 cycles being conducted at 90 percent relative humidity. Electrical tests before, during, and after the cycling disclosed that this treatment was survived by approximately 75 percent of the circuits and that it had virtually no adverse effect on dielectric performance. Author

N71-35374# Toulouse Univ. (France).
COMPUTER ANALYSIS OF TRANSIENT BEHAVIOR OF INTEGRATED LOGIC CIRCUITS [CONTRIBUTION A L'ANALYSE A L'AIDE D'ORDINATEUR DU COMPORTEMENT TRANSITOIRE DE CIRCUITS LOGIQUES INTEGRES]
Henri Jaladieu (Ph.D. Thesis) 1971 139 p refs In FRENCH
(Rept-1143) Avail: NTIS

A presentation is given of the methods used to measure transient behavior and the difficulties encountered in the identification of different parameters of integrated logic circuits. The equations used and the resolution of the system are also given. The analysis was made with digital computer.

Transl. by E.H.W.

N71-35375# Auburn Univ., Ala.
EFFICIENT GENERATION OF MINIMUM FAULT TEST SCHEDULES FOR COMBINATIONAL LOGIC NETWORKS
William A. Hornfeck and Chester C. Carroll Jun. 1971 182 p
(Contract DAAH01-68-c-0296)
(AD-726383; Themis-AU-T-19) Avail: NTIS CSCL 09/2

A number of fault detection procedures for combinational logic networks are discussed and efficient algorithms are developed for the automatic generation of network test inputs. Each of the algorithms is specialized in the sense that each is designed to generate tests for a specific class of logic networks. The analysis and development of the algorithms is based on the assumption of a single error in the form of a struck-at-one or struck-at-zero fault. Algorithms are also included which can be used for no-fan-out networks, sum-of-products and product-of-sum networks, and factored realizations. Test schedules generated by the computer-aided procedures provide both a complete and minimum set of test inputs for the different types of logic networks considered. Author (GRA)

N71-35376# Illinois Univ., Urbana. Coordinated Sciences Lab.
A LOGIC DESIGN PROCEDURE TO FACILITATE FAULT DETECTION
Ralph William Shrader (Ph. D. Thesis) Jun. 1971 105 p refs
(Contract DAAB07-67-C-0199; Grant NSF GK-15459)
(AD-726382; R-513; UILU-ENG-71-2216) Avail: NTIS CSCL 09/1

A procedure that combines the design of a logic network with the generation of fault detection tests is presented. Certain restrictions are placed on the allowable network structure to insure that the designed network is always diagnoseable. The first step in the procedure is to reduce all functions to their prime implicants. An irredundant sum of prime implicants is then selected while fault tests are simultaneously generated. The resultant sum of prime implicants may then be realized in either a two level network for which the test set is sufficient to test all single and all multiple faults or in a multiple level network that satisfied the restriction and for which the test set is sufficient to test all single faults and in some cases all multiple faults. The results are expressed in a decimal numeric notation that is particularly adaptable to a computer implementation.

Author (GRA)

N71-35377# Iowa Univ., Iowa City. Dept. of Mechanical Engineering.
A PATTERN SEARCH ALGORITHM FOR FEEDBACK CONTROL SYSTEM PARAMETER OPTIMIZATION
Truls Lange-Nielsen and George M. Lance Jun. 1971 38 p refs
(Contract DAAF03-69-C-0014; Proj. Themis)
(AD-726465; THEMIS-UI-32) Avail: NTIS CSCL 12/1

The problem of parameter optimization for the purpose of synthesis and design of multi-loop feedback control systems is considered. A flexible performance index, based on performance specifications such as rise time, settling time, peak overshoot and bandwidth is developed and adapted to a modified version of Rosenbrock's pattern search algorithm. Modifications of Rosenbrock's method include scaling of parameters to make coordinate-orthogonalization more effective and employing variable step sizes at the beginning of each new stage, the steps being a function of previous failures and successes. The efficiency of each stage is thus improved and the sensitivity to initial estimates of step sizes is reduced. A stopping criterion for the search based on a given number of consecutive stages with no improvement of the performance index (within the precision of the computer) is shown to be effective. Calculation of sensitivity numbers and desired performance specifications around the optimal point is included to give a feel for system behavior near optimal conditions. The IBM/360 Continuous System Modeling Program (CSMP) is employed, permitting system simulation directly from a block diagram. Author (GRA)

N71-35378 National Lending Library for Science and Technology, Boston Spa (England).
STABILITY WITH VARYING LOADS IN A TWO PORT NETWORK
E. Carli et al 1 Jun. 1971 50 p refs Transl. into ENGLISH from Alta Freq. (Milan), V. 38, no. 12, Dec. 1969 p 958-973
(NLL-PORS-Trans-2733-(9022.81)) Avail: Natl. Lending Library, Boston Spa, Engl.: 5 NLL photocopy coupons

It is demonstrated that a two-port network is absolutely stable if, and only if, it is stable for a least a particular couple of passive loads and furthermore if certain conditions are verified on the imaginary axis of the plane of complex frequency. Particular attention is given to connections existing between these last conditions of stability and the properties of the transformations of impedances through the two-port network. To this end it is very convenient to represent the network by means of the equivalent circuit of Weissfloch-Haus. The treatment is then extended to the case of a general representation by matrices of the two-port network. The possible different behaviour of the network depending on the inversion of the ports and the effect on stability of inserting in cascade networks without losses are analyzed. Procedures for the measurement of parameters which characterize stability, in particular of the Rollett coefficient are presented. Author

11 FACILITIES, RESEARCH AND SUPPORT

Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations.

N71-35379*# General Dynamics/Convair, San Diego, Calif.
ORBITAL RESEARCH CENTRIFUGE. EXPERIMENT PERFORMANCE OPTIONS AND COST, VOLUME 1: SUMMARY Final Report
24 May 1971 53 p
(Contract NAS1-9904)
(NASA-CR-111937; GDC-DCF-70-004-Vol-1) Avail: NTIS CSCL 14B

Comparative information is presented with regard to a comprehensive group of artificial-gravity/zero-gravity experiments and the vehicles or systems which may be employed in their performance. The experiment performance options (EPOs), ranging from simple, internal, rotating devices to rotatable major vehicles, are conceptually designed and analyzed to establish their operating characteristics. Experiments are defined in detail and evaluated in conjunction with the EPOs to determine how well the objectives of each experiment are met. Study results are assembled in an information matrix for convenient comparison of all pertinent EPO characteristics. Author

N71-35380*# General Dynamics/Convair, San Diego, Calif.
ORBITAL RESEARCH CENTRIFUGE. EXPERIMENT PERFORMANCE OPTIONS AND COST, VOLUME 2 Final Report
10 Dec. 1970 513 p refs
(Contract NAS1-9904)
(NASA-CR-111938; GDC-DCF-70-004-Vol-2) Avail: NTIS HC $6.00/MF $0.95 CSCL 14B

The use of orbital centrifuges and alternative methods of acquiring information relative to artificial-g/zero-g questions for advanced spacecraft are compared. The experiment performance options analyzed consist of those which are compatible with the Space Station and Skylab. Detailed comparisons are presented of the cost factors and other aspects such as weight, volume, data quantity, data relevance, and crew time. D.L.G.

N71-35381*# General Dynamics/Convair, San Diego, Calif.
ORBITAL RESEARCH CENTRIFUGE. EXPERIMENT PERFORMANCE OPTIONS AND COST, VOLUME 3. SPACE SHUTTLE COMPATIBLE EXPERIMENT PERFORMANCE OPTIONS (EPOS) Final Report
10 May 1971 381 p refs
(Contract NAS1-9904)
(NASA-CR-111939; GDC-DCF-70-004-Vol-3) Avail: NTIS HC $6.00/MF $0.95 CSCL 14B

Detailed comparisons are presented between the use of orbital centrifuges and alternative methods of acquiring information relative to artificial-g/zero-g questions for advanced spacecraft. The experiment performance options analyzed consist of those which are compatible with the earth-to-orbit shuttle transportation system. Cost factors, in particular, are emphasized in the comparisons; however, such aspects as weight, volume, data quantity, data relevance, crew time, and other factors which affect experiment program decisions are included. D.L.G.

N71-35382*# Comprehensive Designers, Inc., Philadelphia, Pa.
VEHICLE FOR USE IN PLANETARY EXPLORATION Patent Application
Edward Hryniewiecki, inventor (to NASA) Filed 17 May 1971
27 p Prepared for JPL
(Contracts NAS7-100; JPL-95085)
(NASA-Case-NPO-11366; US-Patent-Appl-SN-144139) Avail: NTIS CSCL 13F

A self-propelled vehicle particularly suited for use in traversing hostile terrain is described. The vehicle is characterized by a plurality of mutually independently operable propulsion units, each including an extended leg coupled with the frame of the vehicle for rotation about an axis transversely related and supported by a steerable pedestal. The pedestal contains operating attributes of both a wheel and an endless track which can be employed for propelling the vehicle along a given surface. These functions are selectively operated by a power train functioning to drive the leg in rotation about its axis and/or activating the pedestal in a wheel driven and/or track laying mode of operation. NASA

N71-35383*# DBA Systems, Inc., Melbourne, Fla.
DOCUMENTATION OF PHOTOGRAMMETRIC MISSION SIMULATOR PROGRAM. VOLUME 1: PROGRAM DESCRIPTION Final Technical Report
Aug. 1971 14 p
(Contract NAS9-10256)
(NASA-CR-115171) Avail: NTIS CSCL 14B

Four modules and their applications for the lunar photogrammetric mission simulator are reviewed. Computerized simulation is used effectively in the program. Global block adjustment, multimission block adjustment, mission analysis, and gravity recovery modules are briefly described. J.A.M.

N71-35384*# McDonnell-Douglas Co., St. Louis, Mo. Advanced Engineering.
HYPERSONIC RESEARCH FACILITIES STUDY. VOLUME 1: Summary
2 Oct. 1970 87 p
(Contract NAS2-5458)
(NASA-CR-114322; MDC-A0013-Vol-1) Avail: NTIS CSCL 14B

The research and development requirements for hypersonic aircraft were assessed to provide NASA with descriptions of desirable hypersonic research facilities, and estimates of performance, costs, development schedules, and capabilities. It is concluded that a sound engineering, cost, and planning basis was established for the acquisition of new hypersonic research facilities when the need is appropriate. F.O.S.

N71-35386*# Analytical Mechanics Associates, Inc., Mountain View, Calif.
A STUDY OF TECHNIQUES FOR CALCULATING MOTION-DRIVE SIGNALS FOR FLIGHT SIMULATORS
Bjorn Conrad and Stanley F. Schmidt Jul. 1971 81 p refs
(Contract NAS2-5816)
(NASA-CR-114345; Rept-71-28) Avail: NTIS CSCL 14B

An experimental test plan was developed using the formation-flying task for the validation and refinement of washout circuits (solutions of the motion drive problem). The test plan was executed in conjunction with NASA scientists and test pilots and the results obtained are given. Certain general concepts were also tested, such as the feasibility of motion cue scaling in preferred coordinates, and the usefulness of formation-flying as an experimental tool for motion testing. Some of the results include: (1) a demonstration of the effectiveness of angular-rate and force scaling as a motion attenuation device in realistic simulations, (2) the mechanization and validation of two washout circuits for the All-Axis Motion Generator, and (3) the determination of circuit parameters that can serve as initial trial values for a wide variety of tasks. D. L. G.

N71-35388*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
GENERAL THEORY OF WALL INTERFERENCE FOR STATIC STABILITY TESTS IN CLOSED RECTANGULAR TEST SECTIONS AND IN GROUND EFFECT
Harry H. Heyson Washington Sep. 1971 331 p
(NASA-TR-R-364; L-7549) Avail: NTIS CSCL 14B

A theory is developed which predicts the interference velocities and interference velocity gradients caused by the walls of the tunnel. Large wake deflections are allowed in both the lateral and vertical directions. The theory includes V/STOL and conventional wall-interference theories and ground effect as special cases. Symmetry and interchange relationships between the interference factors are developed and extensive numerical results are presented. Use of the interference factors to correct data depends upon the availability of detailed aerodynamic treatments in nonuniform flow of the model under test. In most tests the available aerodynamic treatments will be found either inadequate or too time consuming for rigorous routine correction of data relating to lateral-directional stability. Author

N71-35387# Atlantic Richfield Hanford Co., Richland, Wash.
TECHNICAL CRITERIA FOR THE PREVENTION OF CRITICALITY
R. E. Tomlinson 15 Apr. 1971 12 p
(Contract AT(45-1)-2130)
(ARH-468-Rev) Avail: NTIS

Technical criteria are defined for use in developing the limits within which chemical processing facilities are to be designed and operated. Topics covered include: specifications, materials to be covered, assumptions, technical review, experimental basis, safety factors, safety mechanism limits, and fire fighting. NSA

N71-35389*# DBA Systems, Inc., Melbourne, Fla.
DOCUMENTATION OF PHOTOGRAMMETRIC MISSION SIMULATOR PROGRAM. VOLUME 5: GRAVITY RECOVERY MODULE Final Technical Report
Aug. 1971 72 p refs

(Contract NAS9-10256)
(NASA-CR-115175) Avail: NTIS CSCL 14B

A module which is designed to simulate the recovery of the lunar gravity potential is outlined. The gravity model is described by the use of spherical harmonics up to the 15th order and 15th degree. Although the program does compute the values for the spherical harmonic coefficients, its major purpose is to compute the variances of the coefficients. The photo times-positions submodule is used to generate the orbital data to be used in the simulator. The orbit integrator is employed both to produce the simulated position data and to assist in the recovery of the gravity potential model. The least squares recovery module is used to find the spherical harmonic coefficients and their variances. The module is designed to work for a wide range of simulated conditions. Up to 2500 positions along an orbit of up to 28 days may be used to recover the gravity model. The gravity model itself may be of any size up to a 15 by 15. The various options which exist are discussed in detail. Author

N71-35389*# DBA Systems, Inc., Melbourne, Fla.
DOCUMENTATION OF PHOTOGRAMMETRIC MISSION SIMULATOR PROGRAM. VOLUME 4: MISSION ANALYSIS MODULE Final Technical Report
Aug. 1971 55 p
(Contract NAS9-10256)
(NASA-CR-115174) Avail: NTIS CSCL 14B

The Mission Analysis Module, acronym MANCE, is a general purpose simulator designed to assist NASA-MSC in planning photogrammetric missions of the lunar surface. This module has the capability of determining the theoretical coverage of frame photography acquired during a lunar orbiting mission. In addition, a number of exposure computations are performed for the purpose of determining an optimum exposure for each photograph. Author

N71-35390*# DBA Systems, Inc., Melbourne, Fla.
DOCUMENTATION OF PHOTOGRAMMETRIC MISSION SIMULATOR PROGRAM. VOLUME 3: MULTI-MISSION BLOCK ADJUSTMENT MODULE Final Technical Report
Aug. 1971 65 p refs
(Contract NAS9-10256)
(NASA-CR-115173) Avail: NTIS CSCL 14B

The multi-mission block adjustment module, computerized analytical tool designed to assist NASA-MSC in planning lunar photogrammetric mission is described. The module is used to compute error statistics for simulations of user specified photogrammetric schemes involving more than one mission. The program is capable of generating hypothetical data typical of the data extracted from photography of the lunar surface acquired from an orbiting vehicle. With this simulated data and accuracy estimates based on real data, the program performs a rigorous least squares adjustment and computes error statistics for the resulting orbitally constrained photogrammetric triangulation net. Based on minimal input (Keplerian elements defining each orbit, photo orientation parameters, image point distribution parameters and object space control data), the program generates a consistent set of photogrammetric data. Author

N71-35391# West Valley Planning Agency, Calif.
ONTARIO INTERNATIONAL AIRPORT IMPACT STUDY, WEST VALLEY, CALIFORNIA
1971 61 p refs Sponsored by Dept. of Housing and Urban Develop.
(PB-199695) Avail: NTIS CSCL 13B

The plans for an international airport to be constructed at Ontario, California are discussed. Subjects involved in site selection and development are described. Employment and population growth trends for the area and the impact on the future of the airport are considered. P.N.F.

N71-35392# Stanford Linear Accelerator Center, Calif.
TWO MILE ACCELERATION PROJECT Quarterly Status Report, 1 Oct. - 31 Dec. 1970
Mar. 1971 69 p
(Contracts AT(04-3)-400; AT(04-3)-515)
(SLAC-130) Avail: NTIS

A status report on the Stanford Linear Accelerator Project covering the period October 1, 1970 to December 31, 1970 is presented. Topics included are accelerator and research area operations, accelerator and research area equipment, and physics research equipment development. Author (NSA)

N71-35393# Little (Arthur D.), Inc., Cambridge, Mass.
ANALYTIC TOOLS FOR THE STUDY OF AIRPORT CONGESTION Interim Report, Oct. 1970 - Sep. 1971
Bernard O. Koopman Sep. 1971 80 p refs
(Contract DOT-FA70WA-2141)
(FAA-RD-71-55) Avail: NTIS

In the analysis of air terminal congestion two distinct interlocking systems have to be considered: (1) the air traffic control system, with its sensors, communication links, computers and displays; and (2) the mechanical system composed of the runways, the ground and air space surrounding them, and the aircraft in their various states of takeoff and waiting for takeoff, of landing, joining the landing pattern, in stacks and so on. The tools of analysis developed in the present report are concerned with the second of these systems, in which the phenomena of congestion are in fact the phenomena of waiting lines and their interactions. A set of tools for calculating the quantitative effects on the performance of the air terminal of various assumed conditions, operational options, and suggested technical improvements is described. The effects on the performance are to be expressed in terms of throughput rates, delay reductions, and diminished numbers of aircraft not accommodated. Author

N71-35394# Picatinny Arsenal, Dover, N.J.
OPTICAL ALIGNMENT TECHNIQUE
A. Davidoff and W. Rayner May 1971 19 p
(AD-726925; PA-TM-2007) Avail: NTIS CSCL 20/6

An optical technique was developed to assure proper alignment of a missile warhead section assembly stand. The initial alignment of an assembly stand was successfully performed at Sierra Army Depot. The required radial tolerance of 0.002 inch at the assembly stand aft plate was obtained. The technique is recommended for future assembly stand setup and inspection. It could be adapted to similar assembly applications, using special fixturing or commercially available equipment. Author (GRA)

N71-35395# Wyle Labs., Inc., Huntsville, Ala.
MODEL STUDY OF THE EXHAUST FLOW NOISE OF THE PROPOSED AEDC HIGH REYNOLDS NUMBER TUNNEL Final Report, Jun. 1969 - Jun. 1970
J. E. Robertson AEDC Jul. 1971 94 p refs
(Contract F40600-72-C-0003)
(AD-727053; ARO-VKF-TR-71-109; AEDC-TR-71-146) Avail: NTIS CSCL 14/2

A study to evaluate the exhaust noise environment of a proposed high Reynolds number tunnel (HIRT) has been conducted. During an earlier phase of this study, prediction of the noise environment resulting from both the starting transient and steady-stage operation of the facility was performed. Also, a model test program was specified to experimentally evaluate the exhaust flow noise. The results of the model test program and new predictions of the full-scale HIRT exhaust noise, based on the model data, are the subjects of the report. Author (GRA)

N71-35396# Cincinnati Univ., Ohio. Design Research Collaborative.
RESEARCH, DESIGN, FABRICATION, AND FIELD TESTING OF A NINETY FOOT SPAN, TWO ARCH EVALUATION SEGMENT, AIRCRAFT MAINTENANCE HANGAR, VOLUME 2 Final Technical Report, 15 Oct. 1969 - 1 Sep. 1970
James M. Alexander, Lawrence E. Spreckelmeier, Behram

Bahramian, and David L. Hunt Wright-Patterson AFB, Ohio AFSC Feb. 1971 153 p refs
(Contract AF 33(615)-3242)
(AD-727051; ASD-TR-71-2-Vol-2) Avail: NTIS CSCL 01/5

A lightweight, 100% recoverable, air-transportable hangar, large enough to accommodate any aircraft up to the size represented by the F-15 and F-111 is needed by the Air Force as part of the inventory of mobility equipment. The concept utilized in the ninety (90) foot span hangar is the same basic system used in the fifty-eight (58) foot span hangar. The concept utilizes sectional arches of aluminum I-beams and 3/4 in. thick modular sandwich panels of polystyrene foam or paper honeycomb faced with sheet aluminum. Arch segments are connected with pairs of aluminum hinges, and the adjacent panels are fastened to the beams with camlocks. Variable length spacers between the arches allow for adjustment to minor terrain variations. A full size two-arch evaluation segment was constructed and field tested. Author (GRA)

N71-35397# Cincinnati Univ., Ohio. Design Research Collaborative.
RESEARCH, DESIGN, FABRICATION, AND FIELD TESTING OF 60 BY 80 FEET AIRCRAFT MAINTENANCE HANGARS AND 30 BY 45 FEET GENERAL PURPOSE SHELTERS, VOLUME 1 Final Technical Report, 15 Oct. 1965 - 15 Nov. 1969
James M. Alexander, John R. McKnight, Karl H. Merkel, and Bahram Bahramian Wright-Patterson AFB, Ohio AFSC Dec. 1970 309 p refs
(Contracts AF 33(615)-3242; F33615-67-C-1259)
(AD-727047; ASD-TR-70-28-Vol-1) Avail: NTIS CSCL 13/13

Aircraft maintenance hangars (50 to 60 ft. span) and general purpose shelters (24 to 30 ft. span) are needed by the Air Force as part of the inventory of mobility equipment. Several concepts are presented. Studies were made for hangars utilizing double curvature modular panels which, when joined together, would form a structurally sound vault. Panels were fiberglass reinforced polyester skins on 1-3/4 in. thick paper honeycomb cores. Panel sizes were limited by the 463 L pallet system. The complexity of integral connecting hardware required to transmit the design stresses rendered this approach uneconomical. A variation utilizing aluminum skins on 3 in. thick single curvature cores resulted in excessive cubage in the packaged mode. A concept utilizing sectional arches of aluminum I-beams and 3/4 in. thick modular sandwich panels proved much more successful. Author (GRA)

N71-35398# Army Test and Evaluation Command, Aberdeen Proving Ground, Md.
MEMBRANE, AIRFIELD SURFACING Final Report
1 Jul. 1971 19 p
(AD-726891; MTP-7-3-071) Avail: NTIS CSCL 01/5

The procedure describes test methods and techniques for evaluating membrane, airfield surfacing, and for determining their suitability for service use by the U. S. Army. Author (GRA)

N71-35399 National Lending Library for Science and Technology, Boston Spa (England).
EXPERIMENTAL STATION FOR OBSERVING THE PROPERTIES OF LIGHTNING
E. Garbagnati et al 1971 21 p refs Transl. into ENGLISH from Elettrotecnica (Milan), v. 57, no. 7, 1970 p 388-397
(NLL-OA-Trans-1150-(6196.3)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

A description is given of an experimental station for carrying out automatic observations of the principal data relating to storm activity and for oscillographic recording of lightning currents picked up by the station. The solutions adopted to minimize the errors of measurement are described and the precision attainable is indicated. Author

N71-35288*# MacNeal-Schwendler Corp., San Marino, Calif.
EXPERIENCES IN NASTRAN INSTALLATION AND TRAINING
Caleb W. McCormick *In* NASA. Langley Res. Center NASTRAN: Users Experiences Sep. 1971 p 569-575 (See N71-36253 22-32)
Avail: NTIS HC $9.00/MF $0.95 CSCL 14B

N71-35289*# Computer Sciences Corp., Silver Spring, Md.
NASTRAN INSTALLATION: IMPLEMENTATION STEPS AND POSSIBLE PROBLEMS ENCOUNTERED
Howard E. Dielmann *In* NASA. Langley Res. Center NASTRAN: Users Experiences Sep. 1971 p 577-586 ref (See N71-36253 22-32)
Avail: NTIS HC $9.00/MF $0.95 CSCL 14B

12 FLUID MECHANICS

Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion.

N71-35400*# Translation Consultants, Ltd., Arlington, Va.
INVESTIGATION OF NONVISCOUS FLOWS OF A RADIATING GAS WITH THE HELP OF DIFFERENTIAL APPROXIMATIONS [ISSLEDOVANIYE NEVYAZKIKH TECHENIY IZLUCHAYUSHCHEGO GAZA S NOM-OSHCHYU DIFFERENTSIALNYKH PRIBLIZHENIY]
S. D. Bezrukikh et al Washington NASA Sep. 1971 14 p refs Transl. into ENGLISH from Zh. Vychislitelnoi Mat. i Mat. Fiz. (Moscow), v. 10, no. 6, 1970 p 1503-1511
(Contract NASw-2038)
(NASA-TT-F-13568) Avail: NTIS CSCL 20D

On a relatively simple gas dynamic model the flow of the radiating gas is examined in the neighborhood of the leading critical point of a blunt object. In addition, a two-stage approximation in the frequency of actual absorbtion coefficients of air was investigated in order to clarify the possibility of using such a model for an approximate account of the selectivity of radiation. Author

N71-35401# Central Electricity Generating Board, Berkeley (England). Nuclear Labs.
FULLY DEVELOPED TURBULENT FLOW THROUGH CONCENTRIC ANNULI
C. J. Lawn and C. J. Elliott Feb. 1971 61 p refs
(RD-B-N-1878) Avail: AEC Depository Libraries

Mean velocity and turbulence data are presented for the fully developed flow of air in three radius ratios of concentric annuli. The shear stress distributions were determined by location of the zero-shear position with hot-wires, and by a sliding sleeve technique. This technique, although not entirely satisfactory, proved the reliability of the first method and allowed nondimensional velocity profiles to be constructed with confidence. These velocity profiles are satisfactorily generated by using an eddy viscosity model and a computer solution. Some of the relevant parameters for more refined calculations, involving the turbulence energy equation, were also evaluated and hypotheses concerning the diffusion of the Reynolds stresses were tested against the data. Author (NSA)

N71-35402*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FLOW CHARACTERISTICS IN THE EXHAUST OF A PULSED MEGAWATT GAS-FED ARC
Charles J. Michels and Thomas M. York (Pa. State Univ., University Park) 1971 8 p refs Presented at 24th Ann. Gaseous Electron. Conf. and 3d Arc Symp., Gainesville, Fla., 5-8

Oct. 1971; sponsored by Am. Phys. Soc.
(NASA-TM-X-67931; E-6599) Avail: NTIS CSCL 20D

The transient flow generated by a pulsed, megawatt-level, gas-fed arc with an applied magnetic nozzle has been examined with a new design piezoelectric pressure tranducer. Sensor thermal conduction and accelerations have been examined and eliminated in the 500 microsecond period of plasma flow. Existence of a large magnitude cold gas pressure front of 20 microsecond duration has been reconfirmed and its relationship to the following plasma flow of about 200 microsecond duration has been examined for the first time. At a point 30 cm from the arc source, initially near vacuum conditions (typically with an arc current of 11.2 kA and 1 tesla applied magnetic field), a pressure pulse of un-ionized gas with a magnitude of 10,000 N/sq m is followed by plasma flows with nearly constant impact pressure of 1000 N/sq m. Pressure and number density in this plasma region are seen to decrease with applied magnetic field strength. With electron density derived from Thomson scattering measurements (10 to the 20th power/cu m) plasma flow velocities on the order of 50,000 m/sec are calculated. Author

N71-35403*# Translation Consultants, Ltd., Arlington, Va.
NUMERICAL INTEGRATION OF THE EQUATIONS OF A THREE-DIMENSIONAL LAMINAR BOUNDARY LAYER ON FLOW LINES [CHISLENNOYE INTEGRIROVANIYE URAVNENIY PROSTRANSTVENNOGO LAMINARNOGO POGRANICHNOGO SLOYA NA LINIYAKH RASTEKANIYA]
V. A. Bashkin Washington NASA Sep. 1971 16 p refs Transl. into ENGLISH from Zh. Vychislitelnoi Mat. i Mat. Fiz. (Moscow), v. 10, no. 6, 1970 p 1491-1502
(Contract NASw-2038)
(NASA-TT-F-13567) Avail: NTIS CSCL 20D

A method of integral relations is used for solving equations of a three dimensional laminar boundary layer in generalized similarity variables. The selection of the boundaries of the partition zones in a flow field is substantiated. The accuracy of the calculation of these equations is investigated and shown acceptable. Author

N71-35404*# Clemson Univ., S.C. Dept. of Mechanical Engineering.
PROPOSED DESIGN AND EXPERIMENTAL PERFORMANCE OF SHORT TWO-DIMENSIONAL CURVED WALL DIFFUSERS UTILIZING SUCTION SLOTS
Tah-Teh Yang and William G. Hudson 3 Sep. 1971 73 p refs
(Contract NAS3-13488)
(NASA-CR-120783) Avail: NTIS CSCL 20D

The feasibility of designing short two-dimensional diffusers utilizing suction through one or more slots in the diffuser walls was investigated. Two wall contour designs were examined in several diffusers with area ratios of 2, 2.5, 3, and 4. For the first design a wall surface velocity distribution with all of the deceleration occurring in a concentrated region was prescribed. Based on this distribution a wall contour was computed using an ideal flow computer program. A suction slot was added in the region of deceleration to prevent flow separation under real flow conditions. Uniform exit velocity distribution and a diffuser effectiveness of 98% were achieved although only at suction rates ranging from 12% to 45% of the inlet flow. The second design had contour walls of circular arc cross section. For this design the diffuser effectiveness for an area ratio of 2.5 increased continuously from 30% to 85% as the suction rate was increased from 0% to 10%. For an area ratio of 4, the highest effectiveness attained with the circular arc design was 72.5%. Author

N71-35405*# Georgia Inst. of Tech., Atlanta. School of Aerospace Engineering.
BEHAVIOR OF NOZZLES AND ACOUSTIC LINERS IN THREE-DIMENSIONAL ACOUSTIC FIELDS Quarterly Report, 1 Jun. - 31 Aug. 1971
Ben T. Zinn, Allan J. Smith, Jr., B. R. Daniel, and W. A. Bell 2 Sep. 1971 18 p refs
(Grant NGL-11-001-085)
(NASA-CR-119941) Avail: NTIS CSCL 20D

The computer program used for the prediction of admittances of slowly-converging nozzles was checked out and is operational. An investigation of oscillatory flows in rapidly-converging nozzles is encountering difficulties satisfying the imposed boundary conditions. Various numerical schemes for circumventing this difficulty are considered. The checkout of the analog-to-digital data reduction program was continued. Twenty-one nozzle tests were conducted. Author

N71-35406# Michigan Univ., Ann Arbor. Cavitation and Multiphase Flow Lab.
ASYMMETRIC CAVITATION BUBBLE COLLAPSE
T. M. Mitchell and F. G. Hammitt Mar. 1971 38 p refs
(Grant NSF GK-13081)
(PB-199560; UMICH-03371-6-T) Avail: NTIS CSCL 20D

Numerical results describing the asymmetric collapse of vapor bubbles in a viscous incompressible liquid for various cases of axial symmetry involving boundary conditions which prevent the maintenance of spherical symmetry are presented using a modified Marker-and-Cell (MAC) technique. The cases studied include an originally slightly non-spherical bubble in an infinite static liquid at uniform pressure; originally stationary spherical bubbles in a pressure gradient, and in a liquid at uniform pressure close to a rigid wall; and finally an originally spherical bubble moving through an otherwise stationary liquid at uniform pressure. In all those cases which involve originally spherical bubbles, the bubble collapses in such a way as to form a jet. Author (GRA)

N71-35407# Illinois Univ., Urbana. Water Resources Center.
TRANSPORT PROCESSES OF PARTICLES IN DILUTE SUSPENSIONS IN TURBULENT WATER FLOW, PHASE 1 Final Report, 15 Feb. 1967 - 30 Jun. 1969
Barclay G. Jones, James A. Scoletto, Charles C. Mesk, Raymond J. Ostensen, and Ronald Robin Mar. 1971 42 p refs
(PB-199710; WRC-RR-40) Avail: NTIS CSCL 20D

Modifications to an existing experimental system have been made and have been demonstrated to provide the required resolution and variable parameterization necessary for a detailed study of dilute particle suspensions in a turbulent water flow. These modifications together with the reasons for their necessity are discussed. Linearization of non-Stokesian drag has been accomplished through the introduction of a diagonal tensor into the Stokes drag force equation. It was found that non-Stokesian effects tend to be of minor importance in the response of water borne particles. Author (GRA)

N71-35408# National Aeronautical Establishment, Ottawa (Ontario).
COMPUTATIONS OF INCOMPRESSIBLE TURBULENT BOUNDARY LAYERS ON ROUGH SURFACES
Y. Y. Chan May 1971 29 p refs
(NRC-12069; LR-546) Avail: NTIS

The extended mixing length formulation for the computation of incompressible turbulent boundary layers has been applied with success to flows over rough surfaces. The roughness effect is introduced into the computation scheme through the boundary conditions by defining a slip velocity at the surface. The method predicts the mean velocity and the turbulent shear stress distributions accurately except for a region near the wall where the flow is influenced locally by the roughness element. Author

N71-35409# Texas A&M Univ., College Station.
AN APPROXIMATE SMALL TIME SOLUTION FOR STRONG RADIATING REFLECTED SHOCK WAVES
Leland A. Carlson Jun. 1971 42 p refs
(Grant NSF GK-5268)
(TAMRF-711-7102) Avail: NTIS

An approximate short time solution for the flow field behind a strongly radiating reflected shock wave has been obtained for

the case where significant radiative cooling occurs prior to chemical relaxation. The solution assumes the gas to be transparent, includes end-wall thermal conduction, and approximately accounts for thermal nonequilibrium. The results demonstrate that radiative cooling processes in the inviscid portion of the shock layer dominate the entire layer and that end-wall conduction effects are normally confined to a very small region near the wall. In addition, the time rate of change of the end-wall pressure is directly dependent upon the magnitude of the radiative emission in the region behind the shock front; and the flow field enthalpy profiles are significantly altered by a factor of two change in the magnitude of the radiative emission. Author

N71-35410# Von Karman Inst. for Fluid Dynamics, Rhode Saint-Genese (Belgium).
CALCULATION OF THE FLOW THROUGH SUPERCRITICAL TURBINE CASCADES, WITH A VIEW TO DESIGNING BLADES WITH REDUCED SHOCK STRENGTH
R. G. Sampson Mar. 1970 89 p refs
(VKI-TN-57) Avail: NTIS

A computer program has been produced which calculates the transonic and supersonic flow regions in a supercritical turbine cascade with a well defined throat. The computer results have been used to demonstrate the effects an expansion on the pressure surface, and a recompression on the suction surface, have on the performance of an existing design. Author

N71-35411*# Cornell Univ., Ithaca, N.Y.
STABILITY OF A PLANE VORTEX SHEET BETWEEN GASES EXCHANGING HEAT BY RADIATION
Burton E. Eno Washington NASA Sep. 1971 91 p refs
(Grant NGL-33-010-042)
(NASA-CR-1931) Avail: NTIS CSCL 20D

The stability of a plane two-dimensional vortex sheet separating thermally radiating gases is investigated by the method of normal modes. The study was prompted by concern for the containment of the uranium gas core in a coaxial jet nuclear rocket. Allowing for transverse variation in the base flow temperature and density, the equations of continuity, momentum, energy, state, nuclear fission internal heat generation, and radiative transfer for an ideal grey gas are formulated for small disturbances and solved numerically. Effects of heat generation, wave reflections at a plane of symmetry, radiative nonequilibrium in the waves, and velocity and density differences across the interface are studied. The effect of base flow thermal radiation across the vortex sheet is also analyzed, by considering a uniformly heat generative, symmetric inner gas with nonuniform base temperature and a faster moving, semi-infinite outer gas. It is shown that the base flow temperature variation has a stabilizing influence. An approximate application of this analysis is made to a nuclear rocket with the conclusion that the disturbed vortex sheet is less unstable because of the radiative transfer. Author

N71-35412# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Aerodynamik.
SIMILAR SOLUTIONS OF HYPERSONIC AXIAL FLOW PAST SLENDER NON-AXISYMMETRIC BODIES [AEHNLICHE LOESUNGEN FUER HYPERSCHALLSTROEMUNGEN UM NICHT ROTATIONSSYMMETRISCHE SCHLANKE KOERPER BEI AXIALER ANSTROEMUNG]
G. Kausche (Ph.D. Thesis - Brunswick Univ.) Mar. 1971 57 p refs in GERMAN; ENGLISH summary
(DLR-FB-71-13) Avail: NTIS; ZLDI Munich: 14 DM

For the two dimensional and axisymmetric steady hypersonic flow past slender bodies at very high Mach numbers there exist similar solutions under certain conditions. The three dimensional problem of hypersonic flow past slender bodies with nearly elliptic cross section is treated. It is shown that similar solutions can also be obtained for slender nonaxisymmetric bodies, if their longitudinal cross section is given by a power law, with y proportional to x sup n, z proportional to x sup n, with x as the coordinate of the axis of the body which is parallel to the flow direction. The prescribed power law shaped shock surface may have any cross section, but the calculated results are only concerned with an elliptical shock. Some of the results were compared with those of other authors. The influence of the hypersonic similarity parameter on the calculated shape of the body is shown for elliptical conical shock surfaces. In the case of power law bodies, it is demonstrated how the body shape is influenced by an alteration of the exponent n and the axis ratio of the shock surface. The calculated pressure distributions are compared with measurements carried out in a hypersonic gun tunnel for the Mach number range from 8 to 12. Author (ESRO)

N71-35413# National Bureau of Standards, Boulder, Colo. Cryogenics Div.
STEAM-WATER, CRITICAL FLOW IN A VENTURI
R. V. Smith Jul. 1971 25 p refs
(NBS-TN-608) Avail: SOD $0.35

The hypothesis that the flow of the gas phase controls critical and near critical two-phase flow for cases where the gas and liquid flow essentially in separate streams is discussed. In the first part of the investigation, a two-component system (air-water) was used. The results substantiate the hypothesis. The analytical results also indicate the use of one dimensional flow equations with reasonably accurate estimates for droplet size and for the drag and heat transfer coefficients (without consideration of mass transfer-vaporization or condensation) describe critical and near-critical flow reasonably well. This indicates that mass transfer may be a secondary effect for these flow conditions. Author

N71-35414# Development Sciences, Inc., East Sandwich, Mass.
A TECHNIQUE FOR THE SYSTEMATIC IDENTIFICATION OF POLLUTION REDUCTION MEASURES, EMIS Final Report
10 Nov. 1970 95 p refs
(PB-199332; APTD-0616) Avail: NTIS CSCL 13B

The alternatives available to government and to private industry as they cope with the conflict of economic growth and pollution abatement are discussed in relating the multifaceted approaches to the problem, the report has two purposes:(1) to minimize the conflict between economic growth and pollution abatement by examining opportunities which are often overlooked and to create an information system which clearly identifies the empirical possibilities available within the pollution abatement strategies considered. This approach, which is called Ecosystem of Machines Information System (EMIS), suggests a way of determining the minimum data needed by integrating data sets with abatement strategy; a way to maximize useful information by collecting data in the context of its use, and a systematic way to judge alternative approaches for particular industries in a decentralized economy. Author

N71-35415# Aeronautical Research Committee, Bangalore (India).
APPROXIMATE SOLUTIONS FOR THE STRUCTURE OF SHOCK WAVES
M. R. Ananthasayanam and R. Narasimha Mar. 1970 47 p refs
(ARC-TN-4) Avail: NTIS CSCL 20D

Approximate solutions of the B-G-K model equation are obtained for the structure of a plane shock wave, using various methods and a least squares technique. A detailed error analysis of variations from predicted values is presented. An asymptotic analysis of the density slope shock thickness for large Mach numbers shows that it scales with the Maxwell mean free path on the hot side of the shock, and that their ratio is relatively insensitive to the viscosity law for the gas. Author

N71-35416*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ZERO GRAVITY LIQUID-VAPOR INTERFACE CONFIGURATIONS IN CONICAL TANKS
Charles M. Spuckler and Kaleel L. Abdalla Washington Sep. 1971 22 p refs
(NASA-TM-X-2400; E-6427) Avail: NTIS CSCL 20D

An experimental investigation was conducted to determine the isothermal liquid-vapor interface configuration in weightlessness for several conical tanks varying in tank cone angle and oriented at various angles to the gravity vector before entering weightlessness. The tank cone angles investigated ranged from 26.6 deg to 81.0 deg. The orientation tests ranged from 0 deg (the apex of the cone located down) to an including 180 deg. The liquid used in the tests had a 0 deg static contact angle with the tank wall. The results obtained give the liquid volumes required to enclose the vapor space (totally wet walls) as a function of tank cone angle and orientation angle. Author

N71-35417*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EXPERIMENTAL LAMINAR, TRANSITIONAL, AND TURBULENT BOUNDARY-LAYER PROFILES ON A WEDGE AT LOCAL MACH NUMBER 6.5 AND COMPARISONS WITH THEORY
Michael C. Fischer and Del V. Maddalon Washington Sep. 1971 58 p refs
(NASA-TN-D-6462; L-7776) Avail: NTIS CSCL 20D

Boundary-layer pitot surveys were obtained at numerous stations along a wedge at 10 deg total incidence in helium at nominal free-stream and local Mach numbers of 20 and 6.5, respectively. Local unit Reynolds number per centimeter varied from 0.056 x 1 million to 0.255 x 1 million and wall temperatures were nearly adiabatic. Mach number, density, and velocity profiles indicate that the boundary layer varied along the surface from laminar to fully turbulent for all but the lowest of four unit Reynolds number test cases. Experimental Mach number, density, and velocity profile shapes and integral thickness parameters along the wedge at two unit Reynolds number test cases were compared with predictions of a finite-difference computation method. These comparisons indicated the need for improved eddy viscosity models to represent better the high-intensity turbulent fluctuations which apparently occur in the transition region. Theoretical predictions of laminar displacement and momentum thicknesses were approximately 30 percent and 35 percent, respectively, below experimental results. This discrepancy may be due to the influence of the finite leading-edge thickness on boundary-layer development. Author

N71-35418# Naval Research Lab., Washington, D.C.
THE RELATIONSHIP OF DRAG REDUCTION TO THE TRANSIENT LAMINAR SHEAR FLOW PROPERTIES OF POLYMER SOLUTIONS Interim Report
Robert J. Hansen 11 Jun. 1971 21 p refs
(AD-726414; NRL-7274) Avail: NTIS CSCL 20/4

The laminar flow of a polymer solution near a flat plate of infinite extent was investigated theoretically for three cases: (a) The plate is impulsively started and moves in its own plane with a constant velocity; (b) The plate executes linear harmonic oscillations in its own plane; (c) Motion of the plate in this plane is a random function of time. By combining the results with a simple model for turbulent flow near a wall, a number of experimentally observed characteristics of the drag reduction phenomenon are predicted. The merits of this transient shear explanation of drag reduction were compared to those of previously offered hypotheses. Some justification was found for expecting the transient shear flow mechanism to be dominant at large flow rates. Author (GRA)

N71-35419# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THERMODYNAMICS OF VAPOR-LIQUID FLOWS
M. D. Vaisman 6 May 1971 312 p refs Transl. into ENGLISH of the book "Termodinamika Parozhidkostnykh Potokov" 1967 p 1-272
(AD-726874; FTD-HC-23-187-69) Avail: NTIS CSCL 20/4

The book presents the general principles of the thermodynamics of a liquid-vapor system and applies them to various cases of adiabatic and nonadiabatic one-dimensional flows in a thermodynamically balanced vapor-liquid medium. The conditions for development of critical flow are considered, and relationships are given for determining the critical speed, boundary flow rates and relationships between thermal parameters. Several cases of nonstationary motion and flow under the conditions of disturbed phase equilibrium of the system are analyzed. Author (GRA)

N71-35420# Polytechnic Inst. of Brooklyn, Farmingdale, N.Y. Dept. of Aerospace Engineering and Applied Mechanics.
NUMERICAL METHODS FOR TWO- AND THREE-DIMENSIONAL VISCOUS FLOW PROBLEMS: APPLICATION TO HYPERSONIC LEADING EDGE EQUATIONS Interim Progress Report
S. G. Rubin and T. C. Lin Apr. 1971 114 p refs
(Grant AF-AFOSR-1843-70)
(AD-726547; PIBAL-71-8; AFOSR-71-0778TR) Avail: NTIS CSCL 20/4

Several explicit and implicit finite-difference methods, useful for treating two- and three-dimensional viscous flow problems, are compared. These techniques are applied to the single-layer equations previously developed by the authors for continuum leading-edge studies. Stability and accuracy of different schemes, effects of linearization, boundary conditions, coordinate systems and grid size, and the need for iteration are discussed. Solutions are presented for equilibrium and rotational non-equilibrium flow fields and comparisons with experimental data are provided. Different models for the pressure gradient (px) term in the streamwise momentum equation are discussed and it is shown that the effects of upstream influence appear in certain px representations that may be useful when these effects are important. The relationship to so-called sub- or super-critical flows is demonstrated. For three-dimensional geometries, a new predictor-corrector method is devised and tested for stability properties. For a right-angle corner geometry, solutions are compared with explicit results obtained with step sizes three orders of magnitude smaller. The need for iteration in obtaining accurate and consistent results is emphasized. The use of these techniques for two-dimensional unsteady Navier-Stokes solutions is discussed. Author (GRA)

N71-35421# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
METHOD OF DETERMINING THE VELOCITY PULSATION OF THE EFFECTIVE FLOW OF A HYPERSONIC WIND TUNNEL
L. V. Novikov et al 22 Jan. 1971 10 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Ser. Tekhn. (USSR), n. 3, 1969 p 16-19
(AD-726606; FTD-HC-23-666-70) Avail: NTIS CSCL 14/2

Development is reported of a method of studying the velocity pulsations of a high-temperature hypersonic flow, based on the existence of an interrelation between the total stagnation pressure pulsations behind the direct shock and the longitudinal velocity pulsations. The theoretical possibility of studying velocity pulsations of a hypersonic working flow in an aerodynamic facility with the aid of miniature pressure transducers is shown. The method developed makes it possible to obtain data concerning the velocity pulsations of a hypersonic working flow with an rms error in amplitude of plus or minus 26 percent and an rms error in frequency of plus or minus 1.5 percent in the frequency range from 20-6000 Hz and with an rms error in amplitude of plus or minus 7 percent and an rms error in frequency of plus or minus 0.3 percent in the frequency range from 0 to 120 Hz. Author (GRA)

N71-35422# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ONE SOLUTION OF THE TRICOMI PROBLEM
S. V. Falkovich 12 Feb. 1971 12 p refs Transl. into ENGLISH from the publ. "Transzvukovyye Techniya Gaza" Saratov, Izd-vo Saratovskogo Univ., 1964 p 3-8
(AD-726592; FTD-HT-23-34-71) Avail: NTIS CSCL 20/4

The article deals with the problems of the plane flow of gas at transonic velocities when there are regions with subsonic and supersonic velocities. Author (GRA)

N71-35423# Michigan Univ., Ann Arbor.
A CRYOGENIC SHOCK TUBE: LOW TEMPERATURE SHOCK WAVES IN MOLECULAR HYDROGEN
Marvel John Yoder (Ph.D. Thesis) Jun. 1971 145 p refs
(Grant AF-AFOSR-1849-70)
(AD-726652; Rept-032150-1-T; AFOSR-71-1961TR) Avail: NTIS CSCL 20/4

A shock tube has been applied to the study of low temperature shock waves in molecular hydrogen and parahydrogen. The Rankine-Hugoniot shock equation, behaves nonclassically for normal hydrogen and parahydrogen. This is due to the change in the number of degrees of freedom across the shock caused by the excitation of the rotational energy states. The predicted Rankine-Hugoniot curves have been experimentally measured and confirmed. This was done by simultaneous measurement of the shock speed and the density ratio; the latter by means of a Mach-Zehnder interferometer with a laser light source. Pressure measurements also were made using a quartz piezoelectric transducer. Rotational relaxation times have been measured for normal hydrogen and parahydrogen. This has been accomplished using a high sensitivity schlieren optical system with a laser light source and a photomultiplier recording system. Author (GRA)

N71-35424# Case Western Reserve Univ., Cleveland, Ohio. Div. of Fluid Thermal and Aerospace Sciences.
A HYDRODYNAMIC MODEL OF DYNAMIC CONTACT ANGLE HYSTERESIS
Richard James Prutow and Simon Ostrach Jan. 1971 215 p refs
(Grant AF-AFOSR-0194-67)
(AD-726635; FTAS/TR-70-56; AFOSR-70-2882TR) Avail: NTIS CSCL 20/4

A qualitative hydrodynamic description of dynamic contact angle hysteresis is developed in terms of the interaction of capillary, viscous, and disjoining forces by considerating the slow motion of a fluid-fluid interface being driven through a capillary tube by an applied pressure gradient. The interfacial stress boundary condition is modified to include the effect of the disjoining pressure. The method of matched asymptotic expansion is then used to obtain the equations which describe the contact angle region and thereby to define the dynamic contact angle. The analysis is limited to small contact angles. The resulting equations describe some of the distinguishing characteristics of the advancing and receding interfaces. The initial velocity dependence of the receding contact angle and of the thickness of the deposited film of the receding interface of a wetting liquid are determined as functions of the capillary, viscous, and disjoining forces. Author (GRA)

N71-35425 National Lending Library for Science and Technology, Boston Spa (England).
A GENERALIZED FUNCTION FOR THE VISCOSITY OF DENSE GASES [OBOBSHCHENNAYA ZAVISIMOSTI VYAZKOSTI PLOTNYKH GAZOV]
V. G. Maksimov et al Apr. 1971 11 p refs Transl. into ENGLISH from Vestsi Akad. Navuk Belarusk. SSR, Ser. Fiz.-Energ. Navuk(Minsk), no. 4, 1968 p 77-82
(NLL-RTS-6400) Avail: Natl. Lending Library, Boston Spa, Engl.: £1 or 3 NLL photocopy coupons; BIS $3.78

An attempt was made to derive a generalized dependence for the viscosity of similar dense gases using the law of corresponding states with a reduction of residual viscosity to a nondimensional form by means of molecular constants. Proofs are presented for the hypotheses that the interaction between molecules may be determined by the centrally symmetrical Lennard-Jones potential and that the residual viscosity is a function of density only. J.M.

N71-35426 National Lending Library for Science and Technology, Boston Spa (England).
OCCURRENCE OF HIGH FREQUENCY PRESSURE OSCILLATIONS DURING HEAT TRANSFER WITH FORCED FLUID FLOW
Sh. G. Kaplan et al 5 Apr. 1971 7 p refs Transl. into ENGLISH from Inzh.-Fiz. Zh. (Moscow), v. 17, no. 3, 1969 p 486-490
(NLL-CE-Trans-5621-(9022.09)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The results of an experimental study of high frequency oscillations occurring under nucleate and film heat transfer conditions are presented. It is shown that the most intensive oscillations having a wide frequency spectrum (from 3000 to 20,000 c.p.s.) occur on transition to film boiling, nucleate boiling is not accompanied by high frequency oscillations. A narrow frequency spectrum appearing in the range developed nucleate boiling is evidently associated with the onset of film boiling. Author

N71-35427 National Lending Library for Science and Technology, Boston Spa (England).
FLOW PATTERNS FOR AN ADIABATIC TWO-PHASE FLOW OF WATER AND AIR WITHIN A HORIZONTAL TUBE
H. H. Schicht 5 Apr. 1971 20 p refs Transl. into ENGLISH from Verfahrenstechnik (Berlin), v. 3, 1969 p 153-161
(NLL-CE-Trans-5472-(9022.09)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

The investigation of the two phase flow of water/air was carried out to establish flow patterns in a horizontal perspex tube of diameter D = 94 mm. The air mass velocity was within the range of sub G = 6 to 75 Kg/sq m), that of the water being within the range of sub L = 35 to 880 Kg/(sq m); under these conditions the flow patterns of waves, surges and annular flows were observed and photographed. A flow pattern chart is proposed for the two phase flow of water/air at ambient temperature and pressure in horizontal tubes whose diameter is approximately 100 mm. Author

N71-35428 Purdue Univ., Lafayette, Ind.
A SECOND-ORDER NUMERICAL METHOD OF CHARACTERISTICS FOR THREE DIMENSIONAL SUPERSONIC FLOW
Victor Harvey Ransom (Ph.D. Thesis) 1970 229 p
Avail: Univ. Microfilms Order No. 70-18715

A new method of characteristics numerical scheme for three-dimensional steady flow has been developed which has second-order accuracy. Heretofore all such schemes for three-dimensional flow have had accuracies less than second order. A complete numerical algorithm for computing internal supersonic flows of the type encountered in ramjet, scramjet or rocket propulsion systems has been developed and programmed for both the IBM 7094 and CDC 6500 computers. The method has been tested for order of accuracy using the exact solution for source flow and Prandtl-Meyer flow. The results of these tests have verified the second-order accuracy of the scheme. Additional accuracy tests using existing methods for solution of two-dimensional axisymmetric flows have shown that the scheme produces accuracies comparable to that of the two-dimensional method of characteristics. Dissert. Abstr.

N71-35429 Maryland Univ., College Park.
APPLICATIONS OF PROJECTION OPERATOR METHOD TO THE THEORY OF HYDRODYNAMICAL EQUATIONS

AND TO THE THEORY OF LIGHT SCATTERING BY SIMPLE FLUIDS
Kingtse Cheng Mo (Ph.D. Thesis) 1969 205 p
Avail: Univ. Microfilms Order No. 70-15506

The Boltzmann equation is solved as an initial value problem. At time t = 0, the system is assumed to be in a local equilibrium state. The generalized Langevin formula is used to derive the hydrodynamic equation at later times t. The analytical properties of the transport coefficients are also discussed. Using a model Boltzmann equation, the self diffusion coefficient is obtained explicitly. It is proven to be analytic with respect to the Fourier transform variable about space and the Laplace transform variable about time. The scattering of light by simple fluids near the critical point is discussed. The multiple scattering amplitude is derived by a semi-classical treatment. The hydrodynamic equations and Ornstein Zernike theory are used to compute the correlation function. Dissert. Abstr.

N71-35430 Rensselaer Polytechnic Inst., Troy, N.Y.
A HYDRODYNAMIC INTERPRETATION OF WAVE MECHANICS
Gordon Albert Schaub, Jr. (Ph.D. Thesis) 1970 77 p
Avail: Univ. Microfilms Order No. 70-19952

Two fluid equations are constructed which correspond to a one-dimensional, one-particle Schrodinger wave equation, and the relation between the latter equation and the former set, as well as that between wave mechanical and fluid states, is investigated. The fluid pressure is defined and steady flow considered. A perturbation scheme for non-steady flow is exhibited and criticized. Interpretations in quantum mechanics, a fluid model with a more elaborate external force, and transitions are briefly discussed. Dissert Abstr.

N71-35431 Alabama Univ., University.
VISCOUS FLOW WITH GAS BUBBLES IN A WAVY WALL TUBE
James Van Hoose French (Ph.D. Thesis) 1970 129 p
Avail: Univ. Microfilms Order No. 70-17937

The flow of a Newtonian viscous liquid in an infinitely long wavy wall tube which has gas bubbles along the centerline is considered. The equations of motion for axisymmetric flow are written in terms of stream function and vorticity. The motion of the gas within a bubble is assumed negligible compared to the motion of the liquid. A coordinate transformation is used such that the tube wall becomes straight and the bubbles are transformed to segments of the centerline. The transformed equations of motion are then numerically solved by use of finite difference approximations for (1) steady state flow of liquid only, (2) time-dependent flow of liquid only, and (3) time-dependent flow with gas bubbles. Difficulties in numerically calculating bubble curvatures restricted the numerical solutions to spherical bubbles, and the use of a pressure boundary condition resulted in convergent solutions for only a few time steps. Dissert. Abstr.

N71-35432 Louisiana State Univ., Baton Rouge.
THE MHD RAYLEIGH PROBLEM WITH UNSTEADY WALL MOTION
Pei-Chong Shih (Ph.D. Thesis) 1970 94 p
Avail: Univ. Microfilms Order No. 70-18558

The flow of an electrically conducting, viscous, incompressible fluid, due to the decelerating impulsive motion as well as accelerating motion of an infinite flat wall, is discussed. The classical Rayleigh problem and MHD Rayleigh problem are two special cases of the problem of decelerating wall motion. The solution for the accelerating wall motion follows immediately from that for the decelerating impulsive wall motion by superposition. For the decelerating impulsive wall motion, it is observed that, in the case of equal diffusion coefficients, the shear stress at the interface and the disturbances in both the velocity and magnetic field increase with an increase in the wall conductivity or the applied magnetic field, and with a decrease in w. For the accelerating wall motion, it is found that, in the case of equal diffusion coefficients, the shear stress at the interface and the disturbances in both the velocity and magnetic field increase as time advances with the increase in the wall conductivity or the value of w and with the decrease in the applied magnetic field. Dissert. Abstr.

N71-35433 Iowa State Univ. of Science and Technology, Ames.
UNSTEADY HELE-SHAW FLOW
Ching-Chi Shih (Ph.D. Thesis) 1970 196 p
Avail: Univ. Microfilms Order No. 70-18906

The oscillating flow of a viscous, incompressible fluid around a circular cylinder of radius a' placed between closely spaced parallel plates seperated by a distance 2h' (Hele-Shaw cell) was studied theoretically by using the techniques of successive approximations and inner-outer expansions. The first approximation showed that the flow field is similar to that for a two dimensional potential flow around a circular cylinder. The solution for both steady and oscillatory flows given by the second approximation was proportional to a function of the frequency of pulsation and the kinematic viscosity of the fluid. Dissert Abstr.

N71-35434 Stanford Univ., Calif.
CONTINUUM PHYSICAL ACOUSTICS
Robert Harold Caulk (Ph.D. Thesis) 1970 85 p
Avail: Univ Microfilms Order. No. 70-16387

The propagation on an infinitesimal plane wave in a fluid is investigated using the principles of balance of momentum, balance of energy, equipresence, material objectivity, and the Clausius-Duhem inequility. The attenuation and dispersion depend on the nature of the fluid and the frequency of wave. A systematic process of approximation for the response functionals is developed based on the concept of fading memory. Absorption and dispersion measures for a forced wave in a simple fluid are obtained by the solution of the linearized differential equations of motion. The use of sound experiments to measure material parameters is discussed. The spectrum of light scattered from random density fluctuations in a simple fluid is considered. The linearized continuum differential equations of motion are used to determine the frequency dependence of the generalized structure factor and therefore the spectrum of the scattered light. Dissert. Abstr.

N71-35435 Stanford Univ., Calif.
TEARING SEPARATION OF VISCOUS FLUID LAYERS UNDER SURFACE TENSION MEMBRANE BOUNDARIES
Alexander Scott Williamson (Ph.D. Thesis) 1970 141 p
Avail: Univ. Microfilms Order No. 70-18507

The two-dimensional steady slow flow of incompressible viscous fluid which branches into two about a membrane is examined. The solution includes the determination of the surface tension membrane boundary. In the first flow, two counter rotating rollers are partially immersed in a bath. The fluid drawn through the narrow gap between the rollers branches, under a surface tension membrane, into thin films which travel round with the rollers to return to the bath. The flow in the narrowest section of the gap (nip) and the flow in the thin roller films are obtained from lubrication theory. Between these regions the flow is found using an iterative finite difference scheme. The flow in which a knife edge, inserted above the nip, forces the flow to separate is also examined based on hydrodynamic lubrication flow. The numerical solution method is used in solving a steady viscous peeling problem. Two flexible tapes, bonded by a layer of viscous fluid, are pulled between two frictionless cylindrical guides and peeled apart over the guides. Dissert. Abstr.

13 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences.

N71-35436*# Northrop Corp., Huntsville, Ala.
ATMOSPHERIC DENSITY VARIATIONS RELATED TO INTERNAL GRAVITY WAVES
E. B. Miller Aug. 1971 36 p refs
(Contract NAS8-20082)
(NASA-CR-61359) Avail: NTIS CSCL 08N

A method for estimating gravity-wave density variation from wind speed profiles between 60 km and 100 km is outlined. The effects of background wind shear and mean temperature appear analytically. Under certain approximations, the background wind shear is seen to have no effect upon the magnitude of gravity wave density variations, although the mean temperature and its vertical gradient may be more significant in this respect. Consideration is given to determining background or mean values from typical vertical profiles of either wind speed or temperature. It is concluded that a single profile, of the usual sort, is inadequate for a valid determination of these mean or background values. Ensemble averaging over several related profiles is recommended. An estimate of density variations is made from the ensemble averaging of 70 mid-latitude wind profiles which was carried out by Rosenberg (1968). This estimate shows density variations between 85 km and 100 km to be about 20 percent of the background density. Author

N71-35437*# Instituto Geofisico del Peru, Lima. Radio Observatorio de Jicamarca.
COORDINATED SATELLITE AND INCOHERENT SCATTER OBSERVATIONS Progress Report
Ronald F. Woodman and C. Pablo Lagos Aug. 1971 74 p refs
(Grant NGR-52-158-001)
(NASA-CR-121984) Avail: NTIS CSCL 03B

Four types of information are presented: (1) electron density and temperature profiles collected at the Jicamarca Radar Observatory, Lima, Peru, located near the magnetic equator, coincident with twenty near-overhead passes of OGO-6: (2) films of Spread-F structure coincident with seven near-overhead passes of OGO-6: (3) electron density contours and vertical plasma drifts coincident with five 6300 A nightglow emission intensities measured at the Huancayo Observatory: and (4) references to papers completed and prepared for publication which are connected with nightglow studies and special events such as a magnetic storm and a solar eclipse. Author

N71-35438*# California Inst. of Tech., Pasadena. Dept. of Physics.
THE INTERPLANETARY MAGNETIC FIELD
Leverett Davis, Jr. Jun. 1971 33 p refs Presented at Conf. on the Solar Wind, Asilomar, Calif., 22 Mar. 1971
(Grant NGR-05-002-160)
(NASA-CR-121901) Avail: NTIS CSCL 03B

The large scale properties of the interplanetary magnetic field as determined by the solar wind velocity structure are reviewed. The various ways in which magnetic fields affect phenomena in the solar wind are summarized. The dominant role of high and low velocity solar wind streams that persist, with fluctuations and evolution, for weeks or months is emphasized. High velocity streams are almost invariably identified with a single magnetic polarity, and most patterns of large scale, regularly recurring phenomena in interplanetary space are best organized by relating them to the high velocity streams. It is suggested that for most purposes the sector structure is better identified with the stream structure than with the magnetic polarity and that the polarity does not necessarily change from one velocity sector to the next. Several mechanisms that might produce the stream structure are considered. A number of observed features are well explained, but typically the regions of high plasma density appear to occur too soon. Author

N71-35439*# Denver Univ., Colo. Dept. of Physics.
SUDDEN IMPULSES IN THE GEOMAGNETOTAIL AND THE VICINITY
V. L. Patel Aug. 1971 28 p refs Presented at 15th Gen. Assembly, IUGG, Moscow, Aug. 1971 Prepared in cooperation with Minnesota Univ., Minneapolis
(Grants NGR-24-005-180; NGR-06-004-058; NSF GA-10999)
(NASA-CR-121900) Avail: NTIS CSCL 03B

Explorer 33 magnetic field observations were analyzed to study the propagation of sudden impulses (si) in the geomagnetic tail and the magnetosheath. Average speed of propagation in these regions is 760 km per sec with a range of 550 to 1230 km per sec. Most of the si have propagation speed which is close to that of the shock wave observed in this region. Positive si is shown to have a positive change in the tail or magnetosheath and a negative si has a similar negative change. Nine out of thirteen correlated si have their origin in the solar wind continuities, while four si have possible origin in the perturbations of tail or magnetosheath field. It is found that the si propagation is not confined to the tail region but it has correlated effects in the magnetosheath also. The propagation region studied is in 2000 to 0200 local time sector. Author

N71-35440*# Pittsburgh Univ., Pa. Space Research Coordination Center.
PHOTOELECTRON EXCITATION OF ATOMIC OXYGEN RESONANCE RADIATION IN THE TERRESTRIAL AIR-GLOW
E. C. Zipf and E. J. Stone Jul. 1971 30 p refs Submitted for publication
(Grant NGR-39-011-002; Contract DA-31-121-ARO(D)-440)
(NASA-CR-121887; SRCC-156) Avail: NTIS CSCL 04A

Recent laboratory measurements of the absolute cross sections for the excitation of the OI(3S) resonance state by electron impact on O and O2 when combined with in situ measurements of the photoelectron energy distribution from 120 to 300 km show that photelectron impact is the principal excitation mechanism for 1304 A resonance radiation in the dayglow; dissociative excitation of O2 is found to play a minor role. The laboratory measurements indicate that the 3S state is strongly populated by cascade processes and imply that the OI transition should be a prominent dayglow emission feature. These experiments also show that the excitation of atomic oxygen by low-energy electron impact cannot account for the 1304 A or 1356 A emission observed in the tropical ultraviolet airglow. Author

N71-35441*# Pennsylvania State Univ., University Park. Ionosphere Research Lab.
REACTIONS OF O(1D) WITH NITROUS OXIDE AND METHANE
Raymond I. Greenburg 23 Jul. 1971 110 p refs
(Grants NGL-09-003; NSF GA-12385; NSF GP-27758)
(NASA-CR-121982; SR-372; PSU-IRL-SCI-372) Avail: NTIS CSCL 04A

The atom O(1D), produced from the photolysis of N2O at 2139 A, reacts with N2O to yield N2 + O2 or 2NO. The quantum yield of production of O(3P), either on direct photolysis or on deactivation of O(1D) by N2O, is less than 0.02 and probably zero. In the photolysis of N2O-CH4 mixtures, the O(1D) atom can react with methane to yield CH3 + OH or O(3P) + CH4. The relative rate constants ratios were determined by the method of chemical difference. By the addition of He, it was determined that the O(1D) atom possesses translational energy in excess of that obtained from thermal equilibrium. Author

N71-35442*# Bellcomm, Inc., Washington, D.C.
GRAVITY AND GRAVITY GRADIENT FROM SPHERICAL HARMONICS, CASE 310

W. G. Heffron 30 Aug. 1971 22 p refs
(Contract NASw-417)
(NASA-CR-121909; B71-08040) Avail: NTIS CSCL 08/14

Beginning with the spherical harmonic expansion for the gravitational potential of a planet, explicit and recursive formulas are presented for the acceleration and gradient of gravity. Figures are given showing the effects on the potential and acceleration of several individual coefficients in the expansion, and also of the potential and acceleration resulting from the sets of coefficients in current use for the earth and moon. Author

N71-35443*# Scientific Translation Service, Santa Barbara, Calif.
BALL LIGHTENING: NEW OBSERVATIONS AND NEW HYPOTHESES [SHAROVYYE MOLNII: NOVYYE NABYUDENIYA I NOVYYE GIPOTEZY]
M. T. Dmitriyev Washington NASA Sep. 1971 25 p refs Transl. into ENGLISH from Priroda (USSR), no. 6, 1971 p 50-59
(Contract NASw-2035)
(NASA-TT-F-13932) Avail: NTIS CSCL 04A

Observations and hypotheses concerning the theoretical interpretation and experimental reproduction of ball lightning are analyzed and discussed. J.M.

N71-35444*# Massachusetts Inst. of Tech., Cambridge. Measurement Systems Lab.
STUDIES OF SPACE EXPERIMENTS TO MEASURE GRAVITATIONAL CONSTANT VARIATIONS AND THE EOTVOS RATIO Progress Report, period ending 1 Apr. 1971
L. S. Wilk, ed. Jul. 1971 306 p refs
(Contract NAS9-8328)
(NASA-CR-115139; PR-8) Avail: NTIS HC $6.00/MF $0.95 CSCL 08N

Space experiments for detecting variations of the Newtonian gravitational constant and for detecting the difference between inertial and passive gravitational mass were examined. These variations are precluded by Einstein's theory of gravitation, the General Theory of Relativity, and the experiments pose strong tests of that theory. Four designs were studied to detect gravitational constant variations. The one that has the best potential for achieving the required resolution is a space-adapted approach. An analysis of the major factors of this experiment uncover no prohibition from attaining a necessary measurement resolution of delta G/G of 1 part in 10 to the 10th power. This is the largest resolution permitted (reserving an order of magnitude for experimental confidence) to detect the maximum effect predicted by the Brans-Dicke theory, for a highly eccentric solar orbit. An experiment is proposed to check the equivalence between inertial and gravitational mass to an accuracy of 1 part in 10 to the 14th power. The proposed instrument design to achieve this experiment is earth orbit appears feasible. Author

N71-35445*# National Aeronautics and Space Administration, Washington, D.C.
MEASUREMENT OF THE TIME FOR PASSAGE OF AN ELASTIC IMPULSE THROUGH A ROCK SPECIMEN UNDER HIGH PRESSURE AND TEMPERATURE EXPERIMENTAL CONDITIONS [IZMERENIYE VREMENI PROKOZHDENIYA UPRUGOGO IMPULSA CHEREZ OBRAZETS GORNOY PORODY V EKSPERIMENTALNYKH USLOVIYAKH VYSOKIKH DAVLENIY ITEMPERATUR]
T. S. Lebedev et al Sep. 1971 8 p refs Transl. into ENGLISH from Geofiz. Sb. Akad. Nauk Ukr. SSR, Inst. Geofiz. (Kiev), no. 3-6, 1970 p 59-63
(NASA-TT-F-13796) Avail: NTIS CSCL 08G

A laboratory installation is described for measuring time of elastic pulses transmission through the rock samples under experimental conditions of high pressures and temperatures. The extremal amplifier of pulses starts the piezoradiators with amplitude up to 2000 V and the pulse minimum duration about 0.1 microseconds. This permitted, the piezoceramic and quartz transmitters are applied with the greatest advantages within a wide frequency range (up to 3-4 MH). To intensify the signals of the piezoreceiver the wideband amplifier is used with a low level of its own noises and interferences. The accuracy of determinations of time for elastic pulse transmission through the sample is + or - 0.05 microseconds. Author

N71-35446*# Scientific Translation Service, Santa Barbara, Calif.
THE ANNUAL HEAT BALANCE OF THE NORTH POLAR CAP OF MARS [GODOVOY BALANS TEPLA SEVERNOY POLARNOY SHAPKI MARSA]
V. I. Aleshin Washington NASA Sep. 1971 7 p refs Transl. into ENGLISH from Astron. Zh. (Moscow), v. 48, no. 3, 1971 p 587-589
(Contract NASw-2035)
(NASA-TT-F-13974) Avail: NTIS CSCL 08L

The annual heat balance of the north polar cap of Mars is calculated. The value of heat flow from the atmosphere and soil to the snow cover is determined. It is shown that near the North pole the heat flow from the atmosphere makes up one-third of the solar heat flow, absorbed by snow. South of 81.5 deg N. l. a part of the heat, excreted from the soil, increases considerably. At high latitudes, gradual accumulation of snow, consisting of CO2 and H2O takes place. As a result, at the North pole about 14.8 g/square centimeter of solid CO2 or 2.34 g/square centimeter of H2O are accumulated per one year. Author

N71-35447# Purdue Univ., Lafayette, Ind. Joint Highway Research Project.
REMOTE SENSING AND DEVELOPMENT OF ANNOTATED AERIAL PHOTOGRAPHS AS MASTER SOIL PLANS FOR PROPOSED HIGHWAYS Final Report
Robert D. Miles, Harold T. Rib, and Marc G. Tanguay 16 Jul. 1970 60 p refs
(PB-199422) Avail: NTIS CSCL 08B

The application of remote sensing systems to the development of master engineering soil plans is discussed. The remote sensing systems consisted of aerial photography, infrared imagery, side-looking airborne radar imagery and multispectral imagery. The multispectral analog data were used in conjunction with a digital computer to semi-automatically produce thematic maps and statistical analysis of reflectance of surfaces. Inference techniques were used to evaluate the photography and imagery. Author (GRA)

N71-35448# Belgian Royal Observatory, Uccle.
EARTH TIDES NEWS BULLETIN, NO. 56 [MAREES TERRESTRES BULLETIN D'INFORMATIONS, NO. 56]
Paul Melchior, ed. 31 Dec. 1969 29 p In FRENCH
Avail: NTIS

A catalog, containing a list of earth tide stations, their locations, and the instruments used in observations, is presented. E.H.W.

N71-35449# Belgian Royal Observatory, Uccle.
EARTH TIDES NEWS BULLETIN, NO. 58 [MAREES TERRESTRES BULLETIN D'INFORMATIONS, NO. 58]
Paul Melchior, ed. 1 Sep. 1970 58 p In FRENCH
Avail: NTIS

Tables covering gravimetric measurement of amplitudes of earth tides are presented. The errors of such measurements are also included. E.H.W.

N71-35450# National Oceanic and Atmospheric Administration, Boulder, Colo.
TECHNIQUES OF HIGH SPATIAL DENSITY MAGNETIC PROFILING AND MAPPING
W. P. Hasbrouck, C. O. Stearns, and M. R. Saunders Dec. 1970 26 p refs
(NOAA-TR-ERL-201-ESL-15) Avail: SOD $0.35

Data acquisition and reduction methods that were used in investigations of large-amplitude, high-wave number, total magnetic field variations overexposed, basic volcanic rocks are described. The continuous profiling and discrete-station field operations procedures are detailed. A double-orthogonal-array mapping technique which eliminates mapping bias and allows full use of a folded (sin x)/x interpolator is also described. Discussion of the digital computer data reduction procedures includes description of single and multiple function editing plots and the corrections for endpoint and traverse-velocity mismatch, traverse-velocity inequality, and nonalignment of correlation points between initial and replicate traverses. An example using data obtained by the continuous profiling procedure is given to show output from progressive stages in the data reduction sequence. Author

N71-35451# Istituto di Fisica Dell Atmosfera, Rome (Italy).
HARMONIC CONSTANTS OF TIDE, AND ELECTRONIC COMPUTER ESTIMATES OF TIDES AND OF TIDE CURRENTS [CONSTANTES HARMONIQUES DE MAREE, PREVISIONS DES MAREES ET DES COURANTS DE MAREE A L'AIDE D'ORDINATEURS ELECTRONIQUES]
M. Giorgi and C. Stocchino 1970 16 p refs In FRENCH
Presented at the Symp. on Tides, Monaco, 28-29 Apr. 1967; Sponsored by Intern. Hydrog. Bur.
(IFA-CP-208) Avail: NTIS

A computer program is described which calculates the harmonic constants of tides gathered by tide stations graphically, and forecasts tides and tide currents. Comparisons with other methods indicate the computer analysis to be accurate.
Transl. By E.H.W.

N71-35452# Academy of Sciences (USSR), Moscow.
COSMIC DATA: MONTHLY REVIEW, NO. 5, MAY 1970
Z. Rapoport, ed. 1971 54 p In ENGLISH and RUSSIAN
Avail: NTIS

The results of observations of geophysical phenomena concerning electric and magnetic states of the upper atmosphere, geomagnetic variations, ionosphere, cosmic rays, and earth currents are presented. Data on solar activity are reported. Data is valid for period of May 1970. Author

N71-35453# National Oceanic and Atmospheric Administration, Miami, Fla. Environmental Research Labs.
THE NOAA RESEARCH FLIGHT FACILITY'S AIRBORNE DATA COLLECTION PROGRAM IN SUPPORT OF THE BARBADOS OCEANOGRAPHIC AND METEOROLOGICAL EXPERIMENT
Howard A. Friedman, John D. Michie, and James D. McFadden Oct. 1970 185 p refs
(NOAA-TR-ERL-198-RFF-4) Avail: SOD $1.50

The three Research Flight Facility (RFF) aircraft, supporting the overall program of BOMEX, flew 146 missions for approximately 1138 hours. During these flights, almost three million digitally recorded meterological observations, numerous sea-surface temperature and water vapor flux measurements, over two million cloud and radar photographs, and other special data were obtained for subsequent analysis and research application. The scientific objectives of the program, the RFF aircraft capabilities, and the instrumentation systems that supported BOMEX are briefly described. An inventory of the BOMEX field experiment data collected by the RFF from May through July 1969 is given. Author

N71-35454# Stanford Univ., Calif. Dept. of Civil Engineering.
ENERGY AND MASS TRANSFER THROUGH AN AIR-WATER INTERFACE
Peter A. Mangarella, A. John Chambers, Robert L. Street, and En Yun Hsu May 1971 191 p refs
(Grant NSF GA-1471)
(SU-TR-134) Avail: NTIS

Energy and mass flux through the interface was determined by applying conservation of energy and mass in the integral equation form. Flux results were also computed on the basis of single vertical profiles; however, results had scatter, and for large waves were high. Normalized temperature and concentration profiles were almost identical for a given fetch and wind speed. They departed only for high wind speed, where waves were breaking and water particles were ejected into the boundary layer. The energy associated with the evaporation came from the thermal field. Over wind waves the Stanton numbers were approximately twice the heat transfer Stanton number over a flat plate. For cases with spray, the mass transfer Stanton numbers were larger than those for the other cases. The bulk-interface temperature difference was proportional to the measured total energy transfer through the interface. Laboratory Stanton number results were in good agreement with field results. Field and laboratory flux results agreed independently of any vertical height scaling. Theoretical models hypothesizing a diffusion layer near the interface appeared best. Data suggest that energy and mass transfer are governed by essentially similar processes. Author

N71-35455# Stanford Univ., Calif. Dept. of Civil Engineering.
AN EXPERIMENTAL INVESTIGATION OF TRANSFER OF MOMENTUM AT AN AIR-WATER INTERFACE
A. John Chambers, Peter A. Mangarella, Robert L. Street, and En Yun Hsu Nov. 1970 177 p refs
(Grant NSF GA-1471)
(SU-TR-133) Avail: NTIS

The effects of swell and air-water temperature differences on momentum transfer and wave properties are examined. The profile method over-predicted the surface shear stress and the integral method under-predicted it. The effects of different air-water temperatures on the air flow properties and the rate of wave growth were small. The flow over a water surface was rough in nature for all velocities, but for a free stream velocity of about 3.6 m/sec, the momentum thickness increased with increasing velocity. At the same velocity the flow over water was essentially smooth; however, the momentum thicknesses at this speed were less than those obtained at higher velocities over a smooth solid boundary. For a free stream velocity of about 6.8 m/sec, higher values of velocity were obtained in the air above a generated wave than over a boundary of only wind-generated waves; at a velocity of about 11.0 m/sec, there was little difference in the compared profiles. Laboratory shear stress data correlated to the ratio of boundary layer thickness to aerodynamic roughness height. A Froude number scaling leads to a good comparison between field and laboratory data. Author

N71-35456# National Oceanic and Atmospheric Administration, Rockville, Md. BOMAP Office.
SHIP'S INFLUENCE ON SURFACE AND RAWINSONDE TEMPERATURES DURING BOMEX
Warren M. Wiener Jun. 1971 48 p refs
(NOAA-TM-ERL-BOMAP-6) Avail: NTIS

A comparative analysis of observations made from conventional facilities located amidships on five fixed ships with data obtained from instruments mounted on a boom extending forward from the bow of each ship is made. The results, based on temperature recording, indicate that the boom measurements probably are more reliable when the relative wind blows off the sea past the boom and then over the ship. When the wind off the sea blows over the ship and then over the boom, however, ship's influence is such that the boom and shipboard instrumentation provide equally reliable measurements. Author

N71-35457# Army Cold Regions Research and Engineering Lab., Hanover, N.H.
SPRING BREAKUP OF THE DELTA RIVER, ALASKA
C. W. Slaughter and H. R. Samide Apr. 1971 37 p refs
(AD-724683; CRREL-SR-155) Avail: NTIS CSCL 08/12

Spring breakup of snow and ice on the Delta River was monitored in 1967. Breakup on this braided river was a relatively calm event, with gradual development of open-water channels from headwaters to mouth. Air temperature data at Big Delta,

near the mouth of the river, indicated an accumulation of 30 positive degree-days above 32 F, using mean daily values, prior to first observation of continuous open water from headwaters to mouth; a corresponding value, but using maximum daily air temperatures, was 224 degree-days. A photographic sequence of breakup at several points along the river is included. Author

N71-35458# Hawaii Univ., Honolulu. Radioscience Lab.
ATLAS OF TOTAL ELECTRON CONTENT PLOTS, VOLUME 6 Technical Report, 1 Jan. - 31 Dec. 1970
P. C. Yuen and T. H. Roelofs 31 Dec. 1970 319 p
(Grants NSF GP-5404; NSF GA-1113; NSF GA-17330)
Avail: NTIS

Diurnal plots of total electron content versus time are presented. The plots were obtained at Hawaii by measuring the Faraday rotation of the polarization of VHF telemetry carrier transmissions from the geostationary satellite ATS 1. Author

N71-35459# Coast Guard, Washington, D.C.
OCEANIC CONDITIONS OFF NORTHEASTERN BRAZIL, FEBRUARY - MARCH AND OCTOBER - NOVEMBER 1966
Merton C. Ingham and Robert B. Elder Dec. 1970 162 p refs
Its Oceanog. Rept. No. 34
(CG-373-34) Avail: NTIS

Oceanic conditions in the upper 1800 meters of the water column off northeastern Brazil are described. The description is based on seven transects of oceanographic stations extending about 700 miles northeast from the coast. The presence of four major near-surface currents (North Brazilian Coastal Current, Equatorial Undercurrent, South Equatorial Current, and Equatorial Countercurrent) and two intermediate-depth water masses (South Atlantic Central Water and Antarctic Intermediate Water) is discussed. Vertical sections of temperature, salinity, and density are included, along with listings of the station data from which they were constructed. Author

N71-35460# National Physical Lab., New Delhi (India). Radio Science Div.
IONOSPHERIC DATA, OCTOBER 1969
Oct. 1969 79 p refs
(RTRC-A173) Avail: NTIS

Tables of hourly values of propagation data for the E and F regions are presented for several areas of India. These include critical frequency, minimum virtual height, f-min, and M(3000)F2 data. Author

N71-35461# National Physical Lab., New Delhi (India). Radio Science Div.
IONOSPHERIC DATA, SEPTEMBER 1969
Sep. 1969 79 p refs
(RTRC-A172) Avail: NTIS

Tables of hourly values of propagation data for the E and F regions are presented for several areas of India. These include critical frequency, minimum virtual height, f-min, and M(3000)F2 data. Author

N71-35462# National Physical Lab., New Delhi (India). Radio Science Div.
IONOSPHERIC DATA, AUGUST 1969
Aug. 1969 68 p
(RTRC-A171) Avail: NTIS

Tables of hourly values of propagation data for the E and F regions are presented for several stations in India. These include critical frequency, minimum virtual height, f-min, and M(3000)F2 data. Author

N71-35463# National Physical Lab., New Delhi (India). Radio Propagation Unit.
SOLAR AND GEOPHYSICAL DATA, PART 2
Apr. 1971 11 p
(RRC-A190-Pt-2) Avail: NTIS

Predicted and observed solar and geophysical data for March 1971 are presented in tables and graphs. The data include sunspot numbers, solar flux, solar flares and their effects, magnetic storms, and SID effects. Author

N71-35464# National Physical Lab., New Delhi (India). Radio Science Div.
ELECTRON TEMPERATURE DEPENDENCE OF F-REGION ABSORPTION
Sudesh Kumari and K. K. Mahajan Apr. 1971 8 p refs
Submitted for publication
(RSD-65; SR-65) Avail: NTIS

From energy balance considerations in the ionosphere, it is shown that F-region absorption, AF, should be a function of the difference between electron and ion temperatures alone. This is tested by using the calculated values of AF from radar backscatter measurements of electron temperature and electron concentration, and is found to be true. Author

N71-35465# Illinois Univ., Urbana. Aeronomy Lab.
PHOTOELECTRON FLUXES IN THE IONOSPHERE COMPUTED BY A MONTE CARLO METHOD
R. J. Cicerone and S. A. Bowhill [1971] 50 p refs
(Grants NSF GA-15526; NSF GA-27296)
Avail: NTIS

The motions of photoelectrons in the ionosphere were simulated by a Monte Carlo technique developed specifically for this purpose. The physical model adopted for these simulations included transport effects, photoelectron collisions (both elastic and inelastic) with the three major neutral gases, and a continuous energy loss to ambient thermal electrons. The Monte Carlo approach allowed angular scattering due to photoelectron-neutral collisions to be considered in a complete and natural fashion. Two model atmospheres corresponding to two levels of solar activity were treated. For each case photoelectron fluxes were computed as functions of altitude, energy, and pitch angle. A photoelectron escape flux of 2.5 x 10 to the 8th power/sq cm/sec, carrying 3.6 x 10 to the 9th power eV/sq cm/sec, was calculated for the moderate solar activity model. The pitch angle distribution of the escaping flux was found to be skewed toward small pitch angles. The magnitudes of the computed fluxes and other features of the results, such as the albedo of the atmosphere, are discussed and compared with satellite and radar measurements and with the results of other calculations. Author

N71-35466# Fraunhofer-Gesellschaft, Garmisch-Partenkirchen (West Germany). Physikalisch-Bioklimatische Forschungsstelle.
MEASUREMENT OF AIRBORNE RADIOACTIVITY AND ITS METEOROLOGICAL APPLICATION Annual Report, 1 Apr. 1969 - 31 Mar. 1970
R. Reiter, R. Sladkovic, K. Poetzl, W. Camuth, and H.-J. Kanter
31 Mar. 1970 110 p refs
(Contract AT(30-1)-4061)
(NYO-4061-2) Avail: NTIS

A technique using stratospheric BE-7 and P-32 as tracers for studying the air mass exchange between stratosphere and troposphere is outlined. Author (NSA)

N71-35467# Washington Univ., Seattle. Dept. of Chemistry.
RADIOCARBON IN THE SEA Progress Report, 15 Aug. 1969 - 1 May 1971
A. W. Fairhall 1 May 1971 25 p refs
(Contracts AT(45-1)-2091; AT(45-1)-2225)
(RLO-2225-T-20-3) Avail: NTIS

Research progress is reported on a study of radiocarbon in the sea, including the design of a C-14 monitoring system, laboratory methods of analysis, geographical locations where most of the samples were collected, results of analysis, and discussion of the results. NSA

N71-35468# Sandia Corp., Albuquerque, N. Mex.
COMPARISON OF TURBULENCE INTENSITY AND STABILITY RATIO MEASUREMENTS TO PASQUILL TURBULENCE TYPES
R. E. Luna and H. W. Church [1971] 9 p refs Presented at Conf. on Air Pollution Meteorol., Raleigh, N. C., 5 Apr. 1971
(SC-DC-70-5443; Conf-710406-1) Avail: NTIS

The intent of the Pasquill categories is that of estimating the diffusive properties of the atmosphere given only a minimum of measurements. The included data distributions show that in the mean, the categories are established in the proper sequence. However, the neutral class, D, does not seem to be an indicator of zero lapse rate of potential temperature. The distribution of standard deviation of azimuth and elevation angle determined by the stability classes have statistically different means, but the deviations are so large that almost any value could belong to any stability class. Author (NSA)

N71-35469# Oregon State Univ., Corvallis. Dept. of Soils.
PHYSICO-CHEMICAL PROPERTIES OF SOILS FROM VOLCANIC ASH Progress Report, 1 Sep. 1970 - 31 May 1971
M. E. Harward 31 May 1971 9 p refs
(Contract AT(45-1)-2227)
(RLO-2227-T-9-1) Avail: NTIS

Ash soils are of scientific interest due to their unique properties and to the presence of large areas of volcanic ash deposits in countries surrounding the Pacific Ocean. Research for determining the sources of ash soil deposits, the applicability of instrumental neutron activation analysis to these studies, and the relationship of physico-chemical reactions to the internal porosity of particles are reported. NSA

N71-35470# Teledyne Isotopes, Palo Alto, Calif.
INTERIM SUMMARY OF RADIOCHEMICAL DATA FOR STS A, AMCHITKA ISLAND, ALASKA, THROUGH 30 JUNE 1969
E. H. Essington, E. J. Forslow, and D. C. Castagnola Jun. 1970 62 p refs
(Contract AT(29-2)-1229)
(NVO-1229-121) Avail: NTIS

Several sites on Amchitka Island, Alaska, are under consideration by the US Atomic Energy Commission for underground nuclear experiments. Environmental samples from the vicinity of these sites were collected and analyzed. Programs are being conducted to generate essential data for radiological effects evaluations of future nuclear experiments. The programs include (1) determination of natural gross beta, gross alpha, and tritium radioactivities occurring in Amchitka's environmental waters and (2) determination and evaluation of radionuclide sorption, dispersion, and migration parameters for Amchitka's rock-water systems. The parameters include distribution and dispersion coefficents, and retardation factors for various radionuclides. Water source locations, sampling procedures, and analytical methods are briefly described. Results of determinations made through June 1969 of radioactivity levels and distribution coefficients are presented. Author (NSA)

N71-35471# Woods Hole Oceanographic Institution, Mass.
GENERAL SUMMARY OF PROGRESS, 1970 - 1971
Vaughan T. Bowen 1971 34 p refs
(NYO-2174-129) Avail: NTIS

The 1970 research activities which were related to determining fallout distribution in oceans are described. These activities include: the analyses of reagent blanks for Cs-137 and Sr-90; interlaboratory comparisons of results from reference sample analyses; measurement of Sr-90 content in Atlantic Ocean surface waters; and measurement of the vertical penetration of fallout in both seawater columns and ocean sediment columns. Data are presented on the Cs-137 and Sr-90 analysis of seawater samples, Sr-90 content of Atlantic Ocean waters; Cs-137 and Sr-90 vertical penetration in waters of Atlantic Ocean and Sargasso Sea; and Cs-137, Pu-239, and Sr-90 vertical profiles in both water columns and sediment cores from the North Atlantic and the western Mediterranean. NSA

N71-35472# Association Francaise pour l'Etude et le Developpement des Applications de l'Energie Solaire, Paris.
MEASUREMENTS OF SOLAR ENERGY IN OCEAN WATERS AND OCEAN PRODUCTIVITY [LA MESURE DE L'ENERGIE SOLAIRE DANS LES EAUX OCEANIQUES ET LA MESURE DE LA PRODUCTIVITE DES OCEANS]
23 May 1970 118 p In FRENCH Proc. of the meeting of the Section Energie Solarie de la Soc. Franc. des Thermiciens, Villefranche-sur-Mer, France 23 May 1970
Avail: NTIS

CONTENTS:

1. GENERAL ASPECTS OF UNDERWATER PHOTOMETRIC MEASUREMENTS Prieur (Paris Univ., France) 14 p (See N71-35473 22-14)
2. DIFFERENT UNDERWATER PHOTOMETERS USED AT THE LABORATORY OF OCEANOGRAPHIC PHYSICS OF THE FACULTY OF SCIENCES OF PARIS Boutler (Paris Univ., France) 22 p (See N71-35474 22-14)
3. REPORT OF THE SCOR-UNESCO WORKING GROUP NO. 15 ON RADIATIVE ENERGY IN OCEANS Ivanoff (Paris Univ., France) 9 p (See N71-35475 22-29)
4. PRIMARY PRODUCTION IN OCEAN BIOLOGY Bougis and Dallot (Paris Univ., France) 19 p (See N71-35476 22-04)
5. METHODS OF MEASURING PHYTOPLANKTON PRODUCTION P. Nival (Paris Univ., France) 37 p (See N71-35477 22-04)
6. REPORT ON THE OCEANOGRAPHIC HELIOTECHNICAL COMMISSION OF COMPLES Touchais (Aix-Marseilles Univ.) 4 p (See N71-35478 22-13)

N71-35473# Paris Univ. (France). Lab. of Oceanographic Physics.
GENERAL ASPECTS OF UNDERWATER PHOTOMETRIC MEASUREMENTS [GENERALITES SUR LES MESURES PHOTOMETRIQUES SOUS-MARINES] c14
Prieur *In* Assoc. Franc. pour l'etude et le Develop. des Appl. de l'Energie Solaire Meas. of Solar Energy in Ocean Waters and Ocean Productivity 23 May 1970 14 p In FRENCH (See N71-35472 22-13)
Avail: NTIS

Some factors like illuminance and luminance are defined. The penetration of visible light into sea water and its spectral and spatial distribution are explained. The relationship between the luminance distribution within the water and the illuminance at the surface are discussed. Different photometric methods and their application to underwater oceanography are outlined. ESRO

N71-35474# Paris Univ. (France). Lab. of Oceanographic Physics.
DIFFERENT UNDERWATER PHOTOMETERS USED AT THE LABORATORY OF OCEANOGRAPHIC PHYSICS OF THE FACULTY OF SCIENCES OF PARIS [LES DIVERS PHOTOMETRES SOUS-MARINS UTILISES AU LABORATOIRE D'OCEANOGRAPHIE PHYSIQUE DE LA FACULTE DES SCIENCES DE PARIS] c14
Boutler *In* Assoc. Franc. pour l'Etude et le Develop. des Appl. de l'Energie Solaire Meas. of Solar Energy in Ocean Waters and Ocean Productivity 23 May 1970 22 p In FRENCH (See N71-35472 22-13)
Avail: NTIS

Different underwater photometers like the bathy-irradiance meter, the spectro-irradiance meter, the thermopile photometers, and the quantameter for measuring the solar energy quantity at different ocean depths are described, and their technical specifications are given. ESRO

N71-35475# Paris Univ. (France). Lab. of Oceanographic Physics.
REPORT OF THE SCOR-UNESCO WORKING GROUP NO. 15 ON RADIATIVE ENERGY IN OCEANS [LES TRAVAUX DU GROUPE DE TRAVAIL NO. 15 DU SCOR-UNESCO SUR LA MESURE DE L'ENERGIE RAYONNANTE DANS LES OCEANS] c29
Ivanoff *In* Assoc. Franc. pour l'Etude et le Develop. des Appl. de l'Energie Solaire Meas. of Solar Energy in Ocean Waters and Ocean Productivity 23 May 1971 9 p In FRENCH (See N71-35472 22-13)
Avail: NTIS

International cooperation for measuring the radiant energy in ocean waters is reviewed. Bathy-irradiance meters, spectro-irradiance meters, thermopiles, and quantameters were used for measuring the energy available for plankton photosynthesis between 250 and 700 nanometers depth. The first experiment took place in the Gulf of California, the second in the Sargasso Sea, Caribbean Sea, and Peruvian area. ESRO

N71-35476# Paris Univ. (France). Faculty of Sciences.
PRIMARY PRODUCTION IN OCEAN BIOLOGY [LA PRODUCTION PRIMAIRE DANS LA BIOLOGIE DES OCEANS] c04
Bougis and Dallot *In* Assoc. Franc. pour l'Etude et le Develop. des Appl. de l'Energie Solaire Meas. of Solar Energy in Ocean Waters and Ocean Productivity 23 May 1970 19 p In FRENCH (See N71-35472 22-13)
Avail: NTIS

Some factors, like the wavelength, the euphotic zone depth, and mineral salts, controlling the plankton primary production, are reviewed. ESRO

N71-35477# Paris Univ. (France). Faculty of Sciences.
METHODS OF MEASURING PHYTOPLANKTON PRODUCTION [LES METHODES DE MESURE DE LA PRODUCTION DU PHYTOPLANCTON] c04
P. Nival *In* Assoc. Franc. pour l'Etude et le Develop. des Appl. de l'Energie Solaire Meas. of Solar Energy in Ocean Waters and Ocean Productivity 23 May 1971 37 p In FRENCH (See N71-35472 22-13)
Avail: NTIS

An electrical analogy model is given for the ocean ecological system. Some direct and indirect methods are listed, the former permitting the estimation of gross production of phytoplankton, the latter giving an estimation of the net production of the ecological system. ESRO

N71-35478# Aix-Marseilles Univ. (France). Faculty of Sciences.
REPORT ON THE OCEANOGRAPHIC HELIOTECHNICAL COMMISSION OF COMPLES [COMMUNICATION SUR LA COMMISSION D'OCEANOLOGIE HELIOTECHNIQUE DU COMPLES]
Touchais *In* Assoc. Franc. pour l'Etude et le Develop. des Appl. de l'Energie Solaire Meas. of Solar Energy in ocean Waters and Ocean Productivity 23 May 1971 4 p In FRENCH (See N71-35472 22-13)
Avail: NTIS

Applications of solar energy in ocean waters for industrial purposes are outlined. ESRO

N71-35479# Geological Survey, Washington, D.C. Water Resources Div.
REMOTE SENSING BIBLIOGRAPHY FOR EARTH RESOURCES, 1969
J. P. Glasby and D. G. Lowe May 1971 194 p refs
Avail: NTIS

A bibliography on remote sensing is presented. Technical material concerning methodology and applications for earth resources studies is cited, stressing advancements in airborne and earth satellite techniques. The citations cover nine subject categories and are arranged alphabetically by title under each category and in consecutive numerical order. Each item includes title, bibliographic citation, and a set of indexing descriptors. Documents are cited for the following fields:(1)agriculture, (2)atmospheric, (3)sciences, (4)cartography, (5)ecology, (6) fisheries, (7)forestry, (8)geodesy, (9)geography, (10)geology, (11)geomorphology, (12)geophysics, (13)glaciology, (14) hydrology, (15)instrumentation, (16)land use, (17)limnology, (18)marine resources, (19)techniques, (20)urbanization, and (21)water resources. Indexes with applicable citation numbers are provided for author, corporate author, and subject terms. The cumulative subject term index at the end of the volume provides the necessary access to the key-word descriptors. Author

N71-35480# National Ocean Survey, Las Vegas, Nev.
ALEUTIAN/AMCHITKA SEISMIC PROGRAM
Kenneth W. King 12 Mar. 1971 29 p refs Sponsored by AEC
(CGS-746-10) Avail: NTIS

The National Ocean Survey seismic program for determining and defining the seismicity of the Rat Island (Alaska) Group and for monitoring the possible changes in normal seismicity which occur during and after nuclear detonations on Amchitka Island is discussed. The seismic network installed in the Aleutian Islands for the purpose of investigating the seismicity of the area on and near Amchitka Island is described. The procedures and schedules for recording and analyzing the seismic data and for maintaining the equipment are included. NSA

N71-35481# Environmental Protection Agency, Rockville, Md. Div. of Abatement.
METROPOLITAN KANSAS CITY INTERSTATE AIR QUALITY CONTROL REGION
Les Nagel and William Dennison Jan. 1971 27 p refs Revised
Avail: NTIS

Quantitative data on fuel burning and refuse disposal practices, air pollutant emissions, and abatement plans are presented for 96 Federally owned facilities in Johnson, Leavenworth, and Wyandotte Counties in Kansas and Buchanan, Cass, Clay, Jackson, Platte, and Ray Counties in Missouri. Summaries by county of fuel-use and pollutant emissions are presented in tabular form. The specific Federal facilities which emit more than 100 tons of carbon monoxide, particulate matter, or hydrocarbons per year and the approximate rate at which they are polluting are listed. Data for the determination of the Federal Government air pollution contribution from mobile sources other than airplanes were not included. Author

N71-35482# Environmental Protection Agency, Rockville, Md. Div. of Abatement.
MILWAUKEE INTRASTATE AIR QUALITY CONTROL REGION
Carl Edlund Dec. 1970 19 p refs
Avail: NTIS

A survey is presented of the contribution by Federal installations to the air pollution in this region. Tables, showing fuel usage and refuse disposal for the Federal facilities, and installations using coal-fired boilers are included. The Federal abatement program for air quality control is also shown. F.O.S.

N71-35483# Soil Conservation Service, Anchorage, Alaska.
SUMMARY OF SNOW SURVEY MEASUREMENTS FOR ALASKA
T. G. Freeman 1 Nov. 1970 114 p
Avail: NTIS

All snow survey data are arranged alphabetically by snow course. A map showing the location of the Alaska snow courses, the map number, and the snow course number is provided to aid in locating the data record for any of the Alaska stations. An alphabetical and a numerical index are also provided before the data summary sheets. Biographical information concerning each

snow course is provided at the head of each snow course data sheet. This includes the identifying number, elevation above sea level, basin and stream in which it is situated, and location by latitude and longitude. In the data tables, the heading entitled YEAR is the terminal value of the water year. That is, 1968 means the 1967-68 water year, or more specifically, October 1, 1967 to September 30, 1968. Author

N71-35484*# National Physical Lab., New Delhi (India). Radio Science Div.
IONOSPHERIC ESTIMATES OF ATOMIC OXYGEN CONCENTRATION FROM CHARGED PARTICLE MEASUREMENTS
K. K. Mahajan Apr. 1971 21 p refs Submitted for publication Sponsored in part by NASA
(NASA-CR-112040; RSD-64) Avail: NTIS CSCL 04A

Radar backscatter and the rocket probe measurements of electron and ion temperatures and electron concentration are used to solve the thermal energy equation for the O(+) ions. By equating the heat gained by the O(+) ions from the hotter thermal electrons, to the heat lost to the cooler neutrals, the concentration of the oxygen atoms, n(O), is deduced. Significant seasonal changes in n(O) are identified. The calculated values of oxygen concentration are found to be consistently smaller than the CIRA (1965) values throughout the latest rising phase (1964-1967) of solar activity. This disagreement is greatest at low solar activity and reduces with the increase in activity. There is, however, general agreement on the time of diurnal maximum of n(O) between the calculated and model values. Author

N71-35485# Department of Highways, Ontario, Downsview.
TRANSPORTATION AIR POLLUTION
M. D. Harmelink and W. J. Peck Jun. 1971 35 p refs
(DHO-RR169) Avail: NTIS

A brief state-of-the-art survey of transportation air pollution is presented. First, the primary types of transportation pollutant are described, namely, hydrocarbons, nitrogen oxides, oxidants, carbon monoxide, sulfur oxides, lead, and particulate matter. Methods of measurement are listed and emission rates for various travel modes (automobiles, diesel trucks and busses, railway, and aircraft) are discussed. The effects of these primary pollutants on health, psyche, vegetation, and materials are described. Finally, various solutions to transportation air pollution are discussed, ranging from automobile emission controls and alternatives to the spark-ignited internal combustion engine to increasing use of public transportation, development of new modes of public transportation, and consideration of air pollution in transportation planning. Author

N71-35486# Danish Meteorological Inst., Charlottenlund.
GROUND BASED GEOMAGNETIC MEASUREMENTS IN GREENLAND WITH AN ACCOUNT OF A SURVEY IN 1965 AND A GENERAL SUMMARY OF OBSERVATIONS PERFORMED SINCE 1587
J. Wilhjelm 1971 101 p refs
(R-15) Avail: NTIS

During the summer of 1965, a geomagnetic survey along the west coast of Greenland was performed. The observational results of the survey are presented in tabular form. Geomagnetic measurements performed in Greenland since the early observations in 1587 are summarized. Future repeat station work is discussed. Author

N71-35487# Research Inst. of National Defence, Stockholm (Sweden).
FINE STRUCTURE AND SMALL SCALE VARIATIONS IN THE MOISTURE CONTENT OF THE TROPOSPHERE [FINSTRUKTUR OCH SMASKALIGA VARIATIONER I TROPOSFAERENS FUKTIGHETSFAELT]
Ulf Hoegstroem Nov. 1969 23 p refs In SWEDISH
(FOA-3-A-3729-60) Avail: NTIS

The general expressions for fluctuations in moisture content of the troposphere are studied, based on a division into large scale and small scale variations. The mechanisms of different turbulence conditions are discussed with theoretical expressions for the fluctuation's intensity. Conditions in the surface layer are then considered for a free atmosphere, with average conditions, with convection, and in connection with inversion surfaces. Quantitative estimates of fluctuation in moisture content emerge from the discussions. The result of this study is that the most powerful fluctuations are to be expected: (1) in the surface layer of the atmosphere with heavy vaporization, (2) in convective cells, in the area where gravitation waves break on inversion surfaces, (4) in the area with clear air turbulence, and (5) localized in baroclinic zones. Author

N71-35488# Research Inst. of National Defence, Stockholm (Sweden).
THE PRINCIPAL EFFECTS OF NUCLEAR EXPLOSIONS ON THE IONOSPHERE [KAERNLADDNINGSEXPLOSIONERS PRINCIPIELLA VERKAN PA JONOSFAEREN]
E. Witalis Feb. 1970 23 p refs In SWEDISH
(FOA-4-C-4415-29) Avail: NTIS

The effect of nuclear explosions at ionosphere height or higher, is described. A survey of the more important aspects of explosions at high levels, such as the geo- and cosmophysical and teletechnical, is presented. The construction of the ionosphere and its important characteristics are indicated, followed by the effect of the explosion's direct ionizing radiation and then the more complicated effects from neutron emission and radioactive fission fragmentation are dealt with. Finally the effects of increased ionization on the propagation of signals at radio frequencies are considered. Author

N71-35489# Research Inst. of National Defence, Stockholm (Sweden). Dept. 3.
DETERMINATION OF AVERAGE WIND IN THE TROPOSPHERE BY MEANS OF RADIO EXPERIMENTS [BESTAEMNING AND MEDELVINDEN I TROPOSFAEREN MED HJAELP AV RADIOEXPERIMENT]
Kjell Oestberg Nov. 1969 40 p refs In SWEDISH
(FOA-3-A-3728-60) Avail: NTIS

A survey of the most important methods available is given for the determination of average wind in the troposphere by means of radio experiments. Only the methods based on the propagation of microwaves beyond the horizon are studied. Special attention is given to experiments which use mean Doppler displacement of the receiving signal. In addition, the propagation cross section is developed for the case of turbulent propagation. Author

N71-35490# New Zealand. Dept. of Scientific and Industrial Research, Wellington. Geophysics Div.
TRAVEL TIME TABLES FOR S WAVES
M. J. Randall 1971 27 p *Its* Seismological Obs. Bull. s-(177) Avail: NTIS

These tables represent world average travel times for S in the sense that they are based on an approximately uniform distribution of earthquakes within the seismic regions of the earth, combined with the existing distribution of observing stations. Consistency with the P table is preserved in two ways: by using the same sample of earthquakes and by adopting a model for the crust and upper mantle which is consistent with that adopted for the P table. While the table is principally intended for use at teleseismic distances, it may also serve as a standard of reference for studies of regional structure. Author

N71-35491# New Zealand. Dept. of Scientific and Industrial Research, Wellington.
SEISMOLOGY AND RELATED RESEARCH IN NEW ZEALAND, 1967 - 1970
M. J. Randall, (comp.) Apr. 1971 38 p refs Presented at Moscow Assembly of the Intern. Union of Geodesy and Geophs., Aug. 1971 *Its* Inform. Ser. No. 83 and Seismological Obs. Bull.

S-178
Avail: NTIS

Tables of the stations involved, the instruments used and the effects of seismic activity in New Zealand are given. An extensive bibliography is included. E.H.W.

N71-35492# Texas A&M Univ., College Station. Dept. of Physics.
TIME OF FLIGHT LIDAR MEASUREMENTS AS AN OCEAN PROBE Technical Report, 16 Dec. 1970 - 1 Jul. 1971
George W. Kattawar and Gilbert N. Plass 1 Jul. 1971 23 p refs Submitted for publication
(Contract N00014-68-A-0308-0002)
(AD-726433; A/M-Ref-71-17T) Avail: NTIS CSCL 08/10

Photons emitted by a narrow laser beam are followed through multiple scattering events in the ocean until registered by a detector at the source position. A realistic ocean model is used which takes account not only of molecular scattering (Rayleigh) and absorption, but also scattering and absorption by the hydrosols (Mie). The single scattering function for the hydrosols is calculated from Mie theory assuming a relative index of refraction of 1.15 and a size distribution with a modal radius of 3 micrometers. Targets with various surface albedos (A) are introduced at various distances from the source. The three dimensional path of the photons is followed by a Monte Carlo technique. When A = or < 0.02 the returned flux per unit photon path length from the targets is greater than the background from the laser beam for any target distance. The returned flux is plotted as a function of the photon path length. In practice the detection distance is limited by the lowest flux which can be detected and the background of natural light. Inhomogeneities in the optical properties of the ocean can also be measured in this way. Author (GRA)

N71-35493# Army Engineer Topographic Labs., Fort Belvoir, Va.
AUTOMATIC CONTOUR DIGITIZER (ACD) Final Report, Aug. 1968 - Jul. 1969
John H. Garlow Apr. 1971 101 p
(AD-726386; ETL-ETR-71-2) Avail: NTIS CSCL 08/2

The report covers the engineer design tests conducted to determine the suitability of the Automatic Contour Digitizer (ACD) system for digitizing map contour line data. The ACD was designed to automate the conversion of graphic contour elevation information to digital form and to store the data on half-inch-wide magnetic computer tape at 556 bits per inch in either contour (string) or profile format. Inputs to the system are existing color separations on 0.007-inch-thick Cronapaque or film base. Up to 24- by 30-inch sheet sizes can be processed. Author (GRA)

N71-35494# Naval Intelligence Command, Alexandria, Va. Translation Div.
THE PROBLEM OF INCREASING THE ACCURACY OF MEASUREMENT OF THE SURFACE TEMPERATURE OF SEAS AND OCEANS BY MEANS OF AN AIRBORNE INFRARED RADIOMETER [K VOPROSU OB UVELICHENII TOCHNOSTI IZMERENIYA TEMPERATURA POVERKHOSTI MOREY I OKEANOV S POMOSHCHYU INFRAKRASNOY RADIOMETRICHESKOY APPARATURY SSAMOLETA]
N. Verenchikov 16 Jul. 1971 13 p refs Transl. into ENGLISH from TR. Gl. Geofiz. Observ. (Leningrad), no. 235, 1970 p 146-154
(AD-726512; NIC-Trans-3228) Avail: NTIS CSCL 08/10

The use of infrared radiometric apparatus to measure the surface water temperature of seas and oceans is seeing increased use at the present time in the Soviet Union and abroad. Its installation aboard aircraft allows data to be collected from large areas in a short period of time. It is extremely important that the measurement errors be as small as possible. The errors in measurement may be divided into static and dynamic varieties. Static errors include those involving errors in the apparatus itself and those which are caused by the effect of the atmosphere on the measurement results; dynamic errors are encountered in connection with averaging the water surface temperature due to the finite dimensions of the field of vision of the apparatus and its inertia. Author (GRA)

N71-35495# Air Force Cambridge Research Labs., Bedford, Mass.
GRADIOMETER APPLICATIONS AND STATUS OF SENSOR DEVELOPMENT
David Anthony 1 Jun. 1971 25 p refs
(AD-727033; AFCRL-71-0314; ERP-355) Avail: NTIS CSCL 14/2

A number of feasible terrestrial and space applications exist for a sensor capable of measuring gravity gradients from a stationary or moving base. These applications include: aerial, marine, and satellite gravimetry; navigation and guidance; mass detection for location of tunnels and for inspection and evaluation of containers, satellites, and on-site missiles; lunar and planetary potential measurements, and asteroid mass measurements. Several different gradiometer designs can be used for these applications and are briefly reviewed. Author (GRA)

N71-35496# Georgia Inst. of Tech., Atlanta. School of Aerospace Engineering.
WINDS OBSERVED FROM JULY 1968 THROUGH NOVEMBER 1970 IN THE 83 TO 216 KM ALTITUDE REGION Final Report, 1 Apr. 1968 - 31 Mar. 1971
Carl G. Justus and Howard D. Edwards May 1971 64 p
(Contract F19628-68-C-0061)
(AD-727036; B-204; AFCRL-71-0311) Avail: NTIS CSCL 04/1

Horizontal winds and shears have been computed from 25 rocket released chemical trails. Tables are presented which give vertical profiles of wind speed, heading, and components and the wind shear components. Eight rockets created releases on the up and down leg of their trajectories. Four of these (November 1970: GENIE, HILDA, IDA, JACKIE) were launched within a ten minute interval and one (HELEN) was associated with near simultaneous releases from three other rockets (GRACE, INGER, JOY). These data are suitable for space and time variation studies. Two pairs of trails (UNA-VANESSA and DORA-EVELYN) are suitable for short time difference study since they were launched within an hour of each other. Horizontal and vertical winds were also computed from chemical puffs on the four pairs of up and down trail releases of the November 1970 series. These point wind data are presented in table form. Graphs of the horizontal trail and wind data, and the vertical point wind data for the November 1970 series are also given. Author (GRA)

N71-35497# Stanford Univ., Calif. Stanford Electronics Labs.
THE SPECTRUM OF THE GEOMAGNETIC ACTIVITY INDEX AP
A. C. Fraser-Smith May 1971 48 p refs
(Contract N00014-67-A-0122-0066; Grant NSF GA-17486; ARPA Order 1733)
(AD-726708; SU-SEL-71-022; TR-1) Avail: NTIS CSCL 08/14

The ionospheric propagation of high-frequency radio waves is profoundly influenced by the variations of sunspot numbers and of geomagnetic activity. Thus, details of these variations, and of the relationship between them, has practical application. The variation of the geomagnetic activity index Ap over the 38-year interval January, 1932 through January, 1970 differs in several important characteristics from the variation of sunspot numbers over the same interval. A spectral analysis approach was used to investigate this variation of AP, as well as its relation to the variation of sunspot numbers. The data analyzed consisted of the 457 monthly average AP indices (AP) for the interval and the corresponding observed monthly sunspot numbers. Several large samples of the original daily Ap indices were also analyzed. Two of the latter samples covered 11-year

intervals (April 1, 1944 - June 2, 1955; and June 1, 1956 - July 31, 1967) and the third covered a 23-year interval (April 1, 1944 - December, 1967). Author (GRA)

N71-35498# Air Force Cambridge Research Labs., Bedford, Mass.
SYNOPTIC AND CLIMATOLOGICAL DENSITY PROFILES FROM CONSTANT PRESSURE SURFACES FOR BALLISTIC COMPUTATIONS
Norman Sissenwine, Allen E. Cole, Henry A. Salmela, and Arthur J. Kantor 4 Mar. 1971 39 p refs
(AD-726994; AFCRL-71-0186; AFCRL-AFSIG-232) Avail: NTIS CSCL 04/1

The influence of atmospheric density on ballistic trajectories of re-entry vehicles usually attains a maximum below 20 kilometers. The most direct and accurate means of estimating this influence is from profiles of density specified at uniform intervals of altitude (usually 2 km) from individual soundings for the time and over the area of re-entry. Unfortunately, vertical distances between levels on constant pressure charts, normally available for obtaining density profiles, are generally greater than 2 kilometers. Unless interpolation between these pressure surfaces for obtaining densities at the 2-km intervals is based on the actual density-altitude relation, the interpolated densities will be in error. Three often-used methods of interpolation are: (1) assumption of a linear decrease of density with altitude, (2) assumption of a linear decrease of the logarithm of density with altitude, and (3) assumption of a linear decrease of density multipliers with altitude, where a density multiplier at the altitude of a constant pressure surface represents the ratio of density to the Standard Atmosphere density at that altitude. The three methods with resultant errors are discussed and evaluated in this report. Author (GRA)

N71-35499# Lowell Technological Inst. Research Foundation, Mass.
LOW FREQUENCY IONOSPHERIC SOUNDING SYSTEM
Final Report, 18 Sep. 1967 - 31 Jul. 1970
Klaus Bibl and Richard Vargas-Vila Jun. 1971 40 p refs
(Contract F19628-68-C-0085)
(AD-727013; LTIRF-325/IP; AFCRL-71-0107) Avail: NTIS CSCL 04/1

The report describes a low frequency vertical pulsed sounder which makes possible soundings of the ionospheric D-region. The system employs the most recent advancements in solid state analog components and digital arrays. It features a digital integrating scheme which is accomplished by generation of a median value of signal from 800 pulses or a multiple thereof. By this means, more than 30 dB in available signal to noise ratio is obtained. With selectable sample spacing as small as 1.5 km, both the normal and abnormal components are separately integrated with quadrature sampling in each of 40 height intervals. Other features of the phase coherent sounder include a pseudo-random phase coding for suppression of phase coherent interference and multiple hop echoes. Author (GRA)

N71-35500# Sea Farm Research Foundation, Inc., Waltham, Mass.
REDUCTION AND ANALYSIS OF SELECTED SPECTRAL EMISSION INTENSITIES AT A POLAR CAP STATION
Final Report, 1 Jul. - 15 Dec. 1970
John H. Frey, David L. Miller, and William L. Fischer 31 Dec. 1970 46 p refs
(Contract F19628-70-C-0216)
(AD-726615; AFCRL-71-0008) Avail: NTIS CSCL 04/1

Data from the One Meter Fastie-Ebert Scanning Spectrometer located at the AFCRL Geopole Station, Thule, Greenland have been catalogued, prepared for scaling and a portion of them scaled and processed on a digital computer to obtain intensities for ten selected spectral emissions in Rayleighs. Some theoretical and practical considerations for the power spectral density computer analysis of the data are presented. A specific approach for processing the data to obtain autocorrelation and power spectral density estimates is proposed. Author (GRA)

N71-35501 National Lending Library for Science and Technology, Boston Spa (England).
PROGNOSIS OF THE WORLD ENERGY SUPPLY BETWEEN NOW AND THE YEAR 2000 WITH REFERENCE TO THE QUANTITY OF ENERGY RAW MATERIALS CONSUMED
Th. R. Seldenrath 12 Mar. 1971 23 p Transl. into ENGLISH from Chem. Weekbl. (Netherlands), v. 66, no. 44, 30 Oct. 1970 p 20-26
(NLL-Trans-1166-(9022.9)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

A statistical assessment is presented of the nuclear energy, solid fuel, petroleum, natural gas, and water power energy resources in the year 2000. The analysis is based on current economic and technical trends in the world energy consumption and not on potential primary energy sources such as solar radiation or heat from the interior of the earth or potential advancements in reactor technology. J.G.M.

N71-35502 National Lending Library for Science and Technology, Boston Spa (England).
THE DEEP STRUCTURE OF THE EARTH'S CRUST ALONG THE BLACK SEA-VORONEZH MASSIF MERIDIONAL PROFILE [GLUBINNOE STROENIE ZEMNOI KORY VDOL MERIDIONALNOGO PERESECHENIYA CHERNOE MORE-VORONOZHSKII MASSIV]
V. B. Sologub et al Apr. 1971 24 p refs Transl. into ENGLISH from Probl. Fiz. Zemli, Geofiz. Sb. Akad. Nauk Ukr. SSR (Kiev), no. 15, 1966 p 48-58
(NLL-RTS-5547) Avail: Natl. Lending Library, Boston Spa, Engl.: £2.30 or 8 NLL photocopy coupons, BIS $8.28

The deep structural characteristics of the earth's crust along the Voronezh massif are discussed based on a deep seismic sounding profile along the equator of the Black Sea. Specific characteristics of the wave field and seismic cross sections of the geologic structures are described. J.M.

N71-35503 Department of Energy, Mines and Resources, Ottawa (Ontario). Earth Physics Branch.
GRAVITY MEASUREMENTS IN CANADA, 1 JANUARY 1967 - 31 DECEMBER 1970
J. G. Tanner and R. A. Gibb 1971 25 p refs *Its* Publ. of the Earth Phys. Branch, v. 42, no. 2
Copyright. Avail: NTIS

This compilation is based on annual reports published by the Associate Committee of Geodesy and Geophysics (ACGG). Measurement techniques and results from individual contributors are disclosed in detail. J.G.M.

N71-35504 Columbia Univ., New York.
THREE STUDIES OF MICROEARTHQUAKES. 1: THE MICROEARTHQUAKE SEISMICITY OF THE DENALI FAULT.. 2: MICROEARTHQUAKE INVESTIGATIONS IN NEVADA. 3: EARTHQUAKES ASSOCIATED WITH UNDERGROUND NUCLEAR EXPLOSIONS
Gary Wynn Boucher (Ph.D. Thesis) 1969 125 p
Avail: Univ. Microfilms Order No. 70-18786

The microearthquake activity along a 900 km long stretch of the great Denali fault in Alaska and western Canada was investigated. The rates of very local microearthquake activity varied from 0 to about 40 events per day. The average microseismicity was found to be about the same as that found for the San Andreas fault. A new fault is proposed in the Dezadeash Lake region of the Denali fault zone, based upon a concentration of microearthquake activity as well as topographic evidence. A microearthquake survey carried out in parts of Nevada, Utah, Idaho, Montana, and Wyoming is reported. Microearthquake results obtained under different recording conditions were normalized and it was found that the details of microseismicity cannot necessarily be predicted from knowledge of previous major earthquake seismicity. Records of a seismographic station network were analyzed and it was found

that underground nuclear explosions with magnitudes greater than 5.0 at the Nevada Test Site were followed by increased seismicity for at least 1 day following the explosions.
Dissert. Abstr.

N71-35506 California Univ., Los Angeles.
X-RAY ANALYSIS AND REPRESENTATION OF PREFERRED ORIENTATIONS IN CRYSTAL AGGREGATES
David Warren Baker (Ph.D. Thesis) 1969 181 p
Avail: Univ. Microfilms Order No. 70-14257

Wn analysis is described which allows the complete orientations of grains to be determined from a suite of pole-figures obtained with the X-ray pole-figure goniometer. The orientation of a grain with respect to the specimen is specified by three Euler angles, and the preferred orientation of the grains by frequency distribution of Euler angles termed the orientation distribution function (ODF). When the ODF is plotted in a Cartesian coordinate system, it has a space group symmetry that is a function of the point group symmetry of the crystal and of the specimen. Only the asymmetric unit of the unit cell of the ODF need be determined in numerical calculations. To determine the ODF the pole-figures are expanded with polyhedral harmonics: the ODF, with symmetrical generalized spherical harmonics, and a least squares solution obtained for a set of linear equations relating the coefficients of the two expansions. The technique may be used to study any monomineralic aggregate and is especially well suited for the analysis of fine-grained specimens. Dissert. Abstr.

N71-36218# Bulgarian Academy of Science, Sofia.
TRANSFORMATION OF GEODETIC GEOGRAPHIC COORDINATES AND ELLIPSOID HEIGHTS, AND THE DETERMINATION OF ELLIPSOIDAL AZIMUTH AND LENGTH OF A GEODETIC LINE, BY MEANS OF SYNCHRONOUS SATELLITE OBSERVATIONS
N. Georgiyev and I. Tolomanov *In* Polish Acad. of Sci. Observations of Artificial Earth Satellites, no. 9, 1969 1970 p 107-119 refs In RUSSIAN; ENGLISH summary (See N71-36206 22-31)
Avail: NTIS

N71-36223# Hungarian Academy of Sciences, Budapest.
DEVELOPMENT OF A GEODETIC EARTH SATELLITE NETWORK [ENTWICKLUNG EINES SATELLITENGEODAETISCHEN WELTNETZES]
F. Helmos *In* Polish Acad. of Sci. Observations of Artificial Earth Satellites, no. 9, 1969 1970 p 161-179 refs In GERMAN; RUSSIAN and POLISH summaries (See N71-36206 22-31)
Avail: NTIS

N71-36224# Czechoslovak Academy of Sciences, Prague.
CONTROL OF THE GEODETIC AZIMUTH BETWEEN TWO DISTANT POINTS
Fr. Khovorka *In* Polish Acad. of Sci. Observations of Artificial Earth Satellites, no. 9, 1969 1970 p 181-189 In RUSSIAN; GERMAN and POLISH summaries (See N71-36206 22-31)
Avail: NTIS

N71-36227# National Academy of Sciences-National Research Council, Washington, D.C.
RESULTS IN SATELLITE GEODESY
J. Rolff *In* Polish Acad. of Sci. Observations of Artificial Earth Satellites, no. 9, 1969 1970 p 209-214 refs (See N71-36206 22-31)
Avail: NTIS

N71-36230# Academy of Sciences (USSR), Moscow.
NUMERICAL RESULTS OF DENSITY VARIATIONS IN THE UPPER ATMOSPHERE, OBTAINED BY CORRELATION ANALYSIS
V. Ye. Chertoprud and M. Kalinkov (Bulg. Acad. of Sci.) *In* Polish Acad. of Sci. Observations of Artificial Earth Satellites, no. 9, 1969 1970 p 247-253 refs In RUSSIAN; ENGLISH summary (See N71-36206 22-31)
Avail: NTIS

N71-36231# Bulgarian Academy of Science, Sofia.
TWENTY-FOUR HOUR TEMPERATURE VARIATIONS IN THE MIDDLE IONOSPHERE
K. B. Serafimov *In* Polish Acad. of Sci. Observations of Artificial Earth Satellites, no. 9, 1969 1970 p 255-261 refs In RUSSIAN; ENGLISH summary (See N71-36206 22-31)
Avail: NTIS

N71-36232# Academy of Science, Paris (France).
INVESTIGATION OF CHANGES IN ATMOSPHERIC DENSITY COMPARED WITH AN ATMOSPHERIC MODEL [DIE UNTERSUCHUNG DER GEGENUEBER DEN ATMOSPHAERENMODELLEN ABWEICHENDEN LUFTDICHTEWERTE]
F. Barlier, M. III (Hung. Acad. of Sci.), and P. Kohler *In* Polish Acad. of Sci. Observations of Artificial Earth Satellites, no. 9, 1969 1970 p 263-275 refs In GERMAN; RUSSIAN and POLISH summaries (See N71-36206 22-31)
Avail: NTIS

N71-36241# Hungarian Academy of Sciences, Budapest.
REFRACTION PROBLEMS AND WAVE PROPAGATION IN DOPPLER GEODETICAL MEASUREMENTS
C. Ferencz, I. Ferencz, and G. Tarcsai *In* Polish Acad. of Sci. Observations of Artificial Earth Satellites, no. 9, 1969 1970 p 361-374 refs (See N71-36206 22-31)
Avail: NTIS

N71-36242# Hungarian Academy of Sciences, Budapest.
RELATIVISTIC EFFECTS AND OPTIMALIZATION IN DOPPLER GEODETICAL MEASUREMENTS
G. Tarcsai and F. Horvath *In* Polish Acad. of Sci. Observations of Artificial Earth Satellites, no. 9, 1969 1970 p 375-383 refs (See N71-36206 22-31)
Avail: NTIS

14 INSTRUMENTATION AND PHOTOGRAPHY

Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders; transducers; aerial photography; and telescopes and cameras.

N71-35508*# National Research Corp., Cambridge, Mass.
DESIGN, FABRICATION AND EVALUATION OF A PROTOTYPE MOLECULAR BEAM GIMBALLED DETECTOR, CONTROL CIRCUITS, AND SIGNAL PROCESSING ELECTRONICS
Wallace S. Kreisman [1971] 72 p refs
(Contract NAS1-8223)
(NASA-CR-111910) Avail: NTIS CSCL 14B

The design, development, and testing of a gimballed system to be mounted on a space vehicle to align instruments such as molecular beam sampler and mass spectrometer with the relative wind are discussed. The gimballed system receives an input signal from ion sensors and rotates in pitch and yaw to bring the measurement instrument to a desired position with respect to the vehicle relative velocity vector. Author

N71-35507*# Stanford Research Inst., Menlo Park, Calif.
TENSILE MICROSTRAIN PROPERTIES OF TELESCOPE MIRROR MATERIALS Final report
John W. Moberly Jun. 1971 29 p refs
(Contract NAS1-9982)
(NASA-CR-111948) Avail: NTIS CSCL 17H

Fused silica, ULE fused silica, and Cer-Vit are nonmetallic mirror materials being considered for use in diffraction-limited optical systems. A critical property of materials for systems in a high microyield stress. Microstrain tensile tests were made to measure the microyielding behavior of the three materials and these are compared to an alloy of beryllium plus 5 wt% copper. The strain sensitivity for the tests was 5 x 10 to the minus 8th power. It was found that fused silica, ULE fused silica, and Cer-Vit, having etched surfaces behaved in an elastic manner showing no microyielding. Tests on fused silica and Cer-Vit having unetched surfaces produced similar results, in that no microyielding was observed. The samples were stressed to 34 to 38 MN/sq m (5000 to 5500 psi) or to their fracture point if it occurred at a lower stress. The beryllium-copper alloy showed a permanent strain after loading to above 21 MN/sq m (3000 psi). The results on the etched nonmetallic samples agree with results determined by previous studies. However, the behavior observed for the unetched samples does not agree with the earlier results, which showed microyielding. Author

N71-35508*# New Hampshire Univ., Durham. Dept. of Physics.
AUTOCORRELATION AND POWER SPECTRUM ANALYSIS FOR X-RAY AND GAMMA RAY SPECTROMETER DATA
Chung-jen F. Tsai (M.S. Thesis) 25 Jun. 1971 88 p refs
(Grant NGL-30-002-021)
(NASA-CR-121899) Avail: NTIS CSCL 14B

The usefulness of autocorrelation and power spectrum analysis computer programs was tested for studying signals from possible X-ray and gamma ray pulsar emitting pulsars such as NP 0532. For checking the program, simulated data were generated including simulated random background, simulated square pulse signals above a random background, and a simulated pulsar signal above a random background. These data are in a discrete and equally spaced time series. The results of the analysis, when the simulated pulsar signal represents a 100% intensity increase above the random background, are in good agreement with an analytical solution. The technique fails to detect a pulsar signal if it has an intensity less than 25% above the random background for a set of 100,000 data points. The sensitivity of the technique was improved with an increased amount of data or increased observation time. Author

N71-35509*# Perkin-Elmer Corp., Pomona, Calif. Aerospace Div.
SUMMARY OF THE DEVELOPMENT OF THE SPECIALIZED QUADRUPOLE MASS SPECTROMETER, PHASE 5 Final Report, Apr. 1971
N. Ierokomos and R. B. Lehotsky Apr. 1971 183 p Revised
(Contract NAS5-11185)
(NASA-CR-121906) Avail: NTIS CSCL 14B

The development of the specialized quadrupole mass spectrometer has resulted in an improved system, which has given performance increases in both the resolving power and dynamic range of the mass spectrometer. Resolving powers of up to m/delta m = 90 were obtained while maintaining 100 percent transmission through the mass filter (for flat-topped peaks). With pointed peaks, resolving powers of up to m/delta m = 900 were demonstrated. The dynamic range of the systems were increased to greater than 1 million. Mechanical isolation of the mass spectrometer from the vacuum envelope has also been performed to reduce stresses on the system imposed by either the envelope construction or by external environmental conditions. Author

N71-35510*# Allied Research Associates, Inc., Concord, Mass. Geophysics and Aerospace Div.
APPLICATIONS OF OPTICAL PROCESSING FOR IMPROVING ERTS DATA, VOLUME 1
Jack J. O. Palgen Oct. 1970 40 p refs 3 Vol.
(Contract NAS5-10343)
(NASA-CR-121978; TR-16-Vol-1; ARA-9G45-68-Vol-1) Avail: NTIS CSCL 14B

An optical noise diagnosis technique for improvement of data received from Earth Resources Technology Satellites is described. A photographic negative or positive in an optical data processor modifies the amplitude or phase of incident coherent light producing a diffraction pattern. The diffraction patterns reflect any sinusoidal pattern in the image. Measurements of the diffraction patterns can provide a quantitative measure of the noise in the image. Author

N71-35511*# Honeywell, Inc., Lexington, Mass. Radiation Center.
TWO-COLOR PHOTOCONDUCTIVE DETECTORS Final Report
James W. Reynolds 13 Aug. 1971 65 p
(Contract NAS5-21150)
(NASA-CR-121852) Avail: NTIS CSCL 14B

Development of two color sandwiched photoconductive HgCdTe detectors is discussed. This two color approach to the problem of multispectral detection uses a sandwich configuration in which two detectors of different cutoff wavelengths are superimposed and intimately coupled by an optical impedance matching layer. Advantages of this sandwich detector include the elimination of channel synchronization and time sharing. The final detectors are capable of very high spectral resolution at an operating temperature of 95 K or higher. Fabrication procedures have been developed for making high performance two color detectors in array form. The bottom detector serves as the substrate for the top detector. An epoxy was developed having a high transmission bandpass at the peak wavelength response of the bottom detector, rejection of the 9.6 micron ozone emission band, high electrical isolation, and good mechanical properties. The bottom detector may show a higher spectral detectivity as the bottom element of a two color detector than as a single color detector because the top detector acts as a cold filter. Author

N71-35512*# Perkin-Elmer Corp., Pomona, Calif. Aerospace Div.
QUADRUPOLE SEGMENTED ROD STUDY Interim Report, Apr. 1971
N. Ierokomos Apr. 1971 62 p ref Revised
(Contract NAS5-11185)
(NASA-CR-121855) Avail: NTIS CSCL 14B

The sensitivity of the quadrupole mass spectrometer is shown to have a strong dependence on the geometry of the entrance fringe fields. The longer an ion stays within a fringe field, which has both alternating current and direct current components, the larger its amplitude of motion; thus, the probability of being eliminated by the rods is higher. By use of parallel plate field geometry an ion experiences a side energy impulse which is proportional to the field strength. By combination of the two effects, achieving maximum ion transmission in a quadrupole is possible. This is physically accomplished by use of segmented rod geometry which only has an alternating current potential on the first rod segments. Considerable computer work was done to determine the ion trajectories in segmented rods. The results however, do not agree with the theoretical analysis of the published data. Author

N71-35513*# National Aeronautics and Space Administration, Washington, D.C.
OPTICAL DEVICES, INSTRUMENTATION: A COMPILATION
[1971] 32 p refs
(NASA-SP-5941(01)) Avail: NTIS CSCL 14B

The methods, techniques, and devices used to solve a wide variety of problems in the field of optics are described. They range from magnifiers for special quality control inspections to a sun shield for the radiometer sensor of a celestial navigation system. The compilation is presented in three sections. The first describes various imaging systems and filters; the second deals with optical systems used in photometry, radiometry, and spectrometry; and the third presents optical devices used in manufacturing and quality control. Author

N71-35814*# Rensselaer Polytechnic Inst., Troy, N.Y.
REDUCTION OF CHROMATOGRAPHIC DATA AND EVALUATION OF A GC MODEL
Gordon L. Benoit Jun. 1971 93 p refs
(Grant NGL-33-018-091)
(NASA-CR-122038; RPI-TR-MP-22) Avail: NTIS CSCL 14B

The chromatographic system features micro-thermal conductivity detectors, an automatic injection valve, and inlet and output signal detection capability. A data reduction program was written to compare the mathematical impulse response to the actual system data. The program convolves the normalized impulse response with the input function to give the convolved response which is compared to the actual data which has been normalized. The program is capable of comparing any model to actual system data. Author

N71-35515*# Carnegie-Mellon Univ., Pittsburgh, Pa. Biophysical Research Lab.
DEVELOPMENT OF NEW MICROSPECTROPHOTOMETRIC INSTRUMENTATION Summary Report
Jerome J. Wolken 15 Aug. 1971 24 p refs
(Grant NGR-39-002-011-4D)
(NASA-CR-122066) Avail: NTIS CSCL 14B

A rapid recording microspectrophotometer was developed for the study of the chemistry of the living cell. A recording spectrophotometer was adapted to provide better resolution, faster time constants, and low light levels, in order to study photosensitive pigments. Descriptions are given of the five models which were developed. The absorption spectrum of chlorophyll and chloroplast pigments were studied, as well as chlorophyll synthesis in the cell during photosynthesis. The microspectrophotometer can be utilized in the identification of hemoglobins and organic compounds present in fossils and extraterrestrial rocks in addition to the study of phototropism and single crystal spectra. K.P.D.

N71-35516*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
GEOLOGICAL USE OF EARTH-ORBITAL PHOTOGRAPHY
Paul D. Lowman, Jr. Aug. 1971 38 p refs Presented at the 22d Intern. Astronautical Congr., Brussels, Sep. 1971
(NASA-TM-X-65682; X-644-71-359) Avail: NTIS CSCL 14E

The geologic applications of orbital photography are reviewed with four case histories of such applications. These case histories include discovery of unmapped faults in southern California, discovery of an unmapped volcanic field in northern Mexico, the finding of evidence that so-called Texas lineament is a broad zone of folding and dip-slip faulting, and the demonstration of the great importance of wind erosion as a land-sculpturing agent in North Africa. These examples show the advantages of orbital photography over aerial photography to be: (1) large area per picture, (2) adaptability to direct study of large areas by individual geologists, (3) coverage of areas inaccessible to aerial photography, (4) global coverage, and (5) availability and economy of color and multispectral coverage. Orbital photographs are also used to check the accuracy of existing geologic maps, to compare the geology and geomorphology of widely separated areas, and to study specific geologic problems involving large areas. Author

N71-35517*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE NIMBUS 4 INFRARED SPECTROSCOPY EXPERIMENT, IRIS-D. PART 1: CALIBRATED THERMAL EMISSION SPECTRA
R. A. Hanel, B. J. Conrath, V. G. Kunde, C. Prabhakara, I. Revah et al Jul. 1971 50 p refs Submitted for publication
(NASA-TM-X-65687; X-622-71-272-Pt-1) Avail: NTIS CSCL 14B

The interferometer spectrometer measures the infrared spectrum of the earth and atmosphere between 400 and 1600 (1/cm). High spectral and spatial resolution and a low noise equivalent radience are characteristic of the instrument. Calibration involved consideration of small departures from unity in the emissivity of the onboard calibration source, imbalance between cold and warm calibration ports, and effects due to orbital variations in instrument temperature. Such higher order corrections an careful data screening processes have insured a high quality data set which can be used in a variety of geophysical and meteorological investigations. Representative data samples are presented which illustrate the behavior of the thermal emission spectra under a variety of conditions encountered in a typical orbit. Current investigations include a study of radiative transfer processes in the atmosphere, examinations of vertical sounding techniques, studies of the statistical properties of the spectra, and the study of global fields of temperature and ozone. Author

N71-35518*# DBA Systems, Inc., Melbourne, Fla.
IN-FLIGHT CALIBRATION OF THE APOLLO 14 500 mm HASSELBLAD CAMERA Final Report
John F. Kenefick, Maurice S. Gyer, and Bill F. Harp 1 Sep. 1971 36 p refs
(Contract NAS9-11667)
(NASA-CR-115176) Avail: NTIS CSCL 14E

Convergent photographs secured while in lunar orbit provided excellent material for performing an in-flight calibration of the Hasselblad camera. Three frames from each of three passes over Descartes were measured and processed through a recently developed self-calibration program in which the elements of interior orientation and lens distortion are treated as variable parameters and are recovered analytically, without the necessity of absolute control in object space. A brief mathematical outline for analytical self-calibration is presented with the results of the Hasselblad calibration. In addition, the results of several simulations are presented to demonstrate the precision with which cameras may be self-calibrated on future lunar missions given specific, but reasonable, photographic geometry. Author

N71-35519*# Conrac Corp., Duarte, Calif. Instrument/Controls Div.
DEVELOPMENT OF A MINIATURIZED, STERILIZABLE, GAMMA-BACKSCATTER ATMOSPHERE DENSITY SENSOR
Richard G. Hasenpflug 1970 130 p
(Contract NAS1-7791)
(NASA-CR-111933) Avail: NTIS CSCL 14B

A gamma backscatter atmosphere density sensor has been designed and a working model fabricated and tested, demonstrating the density measurement capability with severe size, weight, power, and environmental constraints. Preliminary tests on the working model indicated that further work to improve operation in vacuum environments and weight reduction were necessary. Two prototype gamma backscatter atmosphere density sensors, associated electronics, and a source holder are ready for further tests when facilities become available. Author

N71-35520*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
PERFORMANCE EVALUATION OF THE CELESCOPE EXPERIMENT
F. L. Whipple Jul. 1971 259 p refs
(Contract NAS8-1535)
(NASA-CR-121932) Avail: NTIS CSCL 14B

The pertinent engineering experience and performance

evaluation of the celescope experiment during its operational life on OAO 2 are reviewed. Topics discussed include an engineering interpretation of orbital data, an engineering review of the celescope television photometer, and systems changes during orbital operation. It is recommended that for future experiments greater emphasis be placed on designing a more accurate TV photometer. F.O.S.

N71-35521*# Rocketdyne, Canoga Park, Calif.
DEVELOPMENT OF HIGH RESPONSE CRYOGENIC GAS FLOWMETERS Final Report
J. V. Hobbs Mar. 1971 32 p ref
(Contract NAS9-11317)
(NASA-CR-115144; R-8702) Avail: NTIS CSCL 14B

The results are presented of a research and development effort oriented toward producing two high response, drag-body flowmeters for cryogenic gas application. Operating temperature range of the flowmeters is within -300 to +100 F. Flowrate range is zero to one pound per second of gaseous hydrogen for one meter and zero to two pounds per second of gaseous oxygen for the other. The flowmeters are velocity head devices and are modifications of meters previously developed for liquid application. Author

N71-35522# Sperry Rand Corp., Clearwater, Fla. Microwave Electronics Div.
RADIOMETRIC THERMACONDE PROGRAM Final Report, 15 May 1969 - 15 Feb. 1971
T. J. Lammons 15 Feb. 1971 74 p
(Contract CPA-22-69-93)
(PB-199427; SJ-232-6062-15; APTD-0674) Avail: NTIS CSCL 14B

The final report is presented on the development of a microwave radiometer for measuring emission brightness temperature of oxygen molecules in the 50 to 75 GHz range. Included in the report are equipment specifications, requirements, and block diagrams. The instrument is intended to improve the pollution predicting capability of air pollution control personnel. J.G.M.

N71-35523# Helsinki Univ. (Finland).
EQUIPMENT FOR THE CONTINUOUS RECORDING OF INTERNAL FRICTION AT LOW FREQUENCIES AND CONSTANT AMPLITUDE
H. J. Kleemola, S. T. Pekonen, and M. S. Sulonen 1971 17 p refs
(PB-199760; Ph-75) Avail: NTIS CSCL 14B

A device for the continuous measurement of internal friction at low frequencies, which is based upon the inverted torsion pendulum, is described. Continuous oscillation of the pendulum is maintained by a coil which is in the field of a permanent magnet. In the field there is also another coil, the induced voltage of which is amplified, controlled and fed back to the former in such a way that the amplitude of oscillation remains constant in the strain amplitude region .000001 to .0001. The pendulum oscillates at the resonance frequency, and thus the possible frequency range in the equipment is about 1 to 20 cycles per second depending on the dimensions of the specimen and the inertia member used. The specimen under test can be plastically deformed in situ at any testing temperature. The pendulum is situated in a chamber which can be evacuated if vacuum conditions are needed. Author (GRA)

N71-35524# Japan Atomic Energy Research Inst., Tokyo.
JAERI NUCLEAR INSTRUMENT MODULE SYSTEM 8
Jan. 1971 82 p In JAPANESE; ENGLISH summary
(JAERI-Memo-4303) Avail: AEC Depository Libraries

Six kinds of the modules are described. General descriptions, specifications, circuit descriptions, and performance data for each unit are summarized. These units are Model 131A multimode amplifier, Model 136A single channel analyzer, Model 140B detector bias supply, Model 144A biased amplifier, Model 148A logic shaper and delay, and Model 152A double delay line amplifier. Author (NSA)

N71-35525# Royal Observatory, Edinburgh (Scotland).
PHOTOGRAPHIC PHOTOMETRY WITH CALCITE FILTER CALIBRATION. INHERENT ERRORS IN THE METHOD. ITS USE IN THE NEAR INFRARED.
Peter W. J. L Brand and M. T. Brueck 1971 15 p refs *Its* Publ., vol. 7, no. 3
Avail: NTIS

CONTENTS:
1. PHOTOGRAPHIC PHOTOMETRY WITH CALCITE FILTER CALIBRATION: INHERENT ERRORS IN THE METHOD P. W. J. L Brand (Edinburgh Univ.) p 35-42 refs (See N71-35526 22-14)
2. PHOTOGRAPHIC PHOTOMETRY WITH CALCITE FILTER CALIBRATION: ITS USE IN THE NEAR INFRARED M. T. Brueck (Edinburgh Univ.) p 43-45 refs (See N71-35527 22-14)

N71-35526# Edinburgh Univ. (Scotland). Dept. of Astronomy
PHOTOGRAPHIC PHOTOMETRY WITH CALCITE FILTER CALIBRATION: INHERENT ERRORS IN THE METHOD
Peter W. J. L Brand *In* Roy. Obs. Phot. Photometry with Calcite Filter Calibration 1971 p 35-42 refs (See N71-35525 22-14)
Avail: NTIS

Results of an investigation into the effects of aberrations and reflection coefficients in a light beam passing through a double calcite plate are given in a general form which is applied to the optical system of a Schmidt telescope. This indicates that field curvature, astigmatism, and spherical aberration operate to limit the photometric accuracy of the calcite filter method. Author

N71-35527# Edinburgh Univ. (Scotland). Dept. of Astronomy.
PHOTOGRAPHIC PHOTOMETRY WITH CALCITE FILTER CALIBRATION: ITS USE IN THE NEAR INFRARED
M. T. Brueck *In* Roy. Obs. Phot. Photometry with Calcite Filter Calibration 1970 p 43-45 refs (See N71-35525 22-14)
Avail: NTIS

The calcite-Polaroid method permits the extension of infrared calibration by about five magnitudes further, provided some photoelectric I values are known. While photographic magnitudes are given with an rms error of +0.07, the method may produce systematic errors increasing this figure to +0.10 magnitude for the faintest stars. Author

N71-35528# Oregon State Univ., Corvallis. Dept. of Civil Engineering.
AERIAL PHOTOGRAPHIC TRACING OF PULP MILL EFFLUENT IN MARINE WATERS
Fred J. Burgess and Wesley P. James Aug. 1970 162 p refs
(Grant WP-00524)
(Rept-12040EBY) Avail: SOD $1.25

Aerial photography taken of waste plumes from pulp mill ocean outfalls was shown to be an effective tool in the study of waste disposal sites. This technique is not limited by sea conditions and permits monitoring and evaluation of outfall sites throughout the year. Photography taken at one instant provides comprehensive information throughout the waste field. Manpower requirements and costs for this method are considerably less than for conventional boat sampling surveys. Waste concentrations were measured by conventional boat sampling techniques while aerial photography was taken of the outfall area from altitudes ranging from 3,000 to 11,000 ft. Computerized procedures were used to compute water currents, waste concentrations, toxicity zones and diffusion coefficients from the photography. Surface water current was found to be the dominant factor in the resulting plume pattern. Temperature was found not to be an effective tracer for tracking the plume or

for estimating waste concentrations since the resulting plume temperature may be greater than, less than or equal to the surrounding ocean temperature. Author

N71-35529# California Univ., Berkeley. Lawrence Radiation Lab.
EIGHTY-LENS OPTICAL CAMERA FOR RECORDING DYNAMIC STUDIES WITH THE SCINTILLATION CAMERA
Hal O. Anger May 1971 9 p refs
(Contract W-7405-eng-48)
(UCRL-20699) Avail: NTIS

An optical camera for continuous recording of information with a scintillation camera for dynamic studies is described. The 80-lens camera described eliminates the loss of information during frame advance that is inherent in other camera systems. NSA

N71-35530*# National Aeronautics and Space Administration. Electronics Research Center, Cambridge, Mass.
ABSOLUTE CAPACITANCE MICROCREEP AND DIMENSIONAL STABILITY MEASURING SYSTEM
John W. Lyons, Jr. Washington Sep. 1971 19 p refs
(NASA-TM-X-2046) Avail: NTIS CSCL 14B

An absolute capacitance microcreep and dimensional stability measuring system is described. The salient features of the system are the long time stability and strain sensitivities (10 to the minus 9th power in. or less) that can be achieved. Microcreep and dimensional stability results obtained on various materials for 1000 hour durations are presented. Author

N71-35531# National Bureau of Standards, Boulder, Colo. Cryogenics Div.
AN EVALUATION OF POSITIVE DISPLACEMENT CRYOGENIC VOLUMETRIC FLOWMETERS
J. A. Brennan, J. W. Dean, D. B. Mann, and C. H. Kneebone Jul. 1971 129 p refs
(NBS-TN-605) Avail: SOD $1.25

A research program on cryogenic flow measurement is discussed. A cryogenic flow research facility was constructed and was first used to evaluate commercially available cryogenic flowmeters operating on a positive displacement principle. The operation and the accuracy of the flow facility are described. The performance of the flowmeters on liquid nitrogen is described by reporting the precision and bias of the meters before and after an 80-hour stability test and by defining the existence of temperature, flow rate, subcooling, and time order (wear) dependencies. Meters were evaluated with flow rates ranging from 20 to 100 gpm pressures ranging from 32 to 112 psia and with temperatures ranging from 72 to 90 K. Author

N71-35532# Philco-Ford Corp., Palo Alto, Calif. WDL Div.
IMAGE ENHANCEMENT OF APOLLO 9 PHOTOGRAPHS
28 Jul. 1971 13 p
(DI-14-08-0001-12539)
(WDL-TR-4279) Avail: NTIS

A photo-optical technique, image enhancement, which detects tone and small density changes is discussed. The technique assigns contrasting false colors to successive density steps so that levels can be distinguished from each other. Several multispectral seperation negatives from Apollo 9 photographs are analyzed. E.H.W.

N71-35533# Research Inst. of National Defence, Stockholm (Sweden).
INSTRUMENT FOR MEASURING NIGHT LIGHT [NATTLJUSMAETARE]
Oesten Johansson and Sten Norlander Mar. 1970 27 p In SWEDISH
(FOA-2-C-2387-52) Avail: NTIS

An apparatus for measuring ground illumination at night is described. Directions for use of the night light meter are presented. When connected to a recorder, as automatic record of the measurements of illumination is obtained. Remote readings from distances of 100 meters are possible. Author

N71-35534# Research Inst. of National Defence, Stockholm (Sweden).
CONSIDERATION OF REQUIREMENTS FOR A STREAK CAMERA FOR REPRODUCTION UNDER WATER [BERAEKNING AV PRESTANDA FOER SVEPKAMERA FOER AVBILDNING UNDER VATTEN]
Arne Hegard Mar. 1970 16 p In SWEDISH
(FOA-2-C-2384-51) Avail: NTIS

Information which can be used for calculating parameters for a streak camera with narrow angle optics for under-water pictures is presented. Simple diffusion theory is assumed. The information is used for calculating the range for a scanning camera with a light source of 1 W and a resolution of 1 dm. The order of size of the calculated range is then 25 m. The influence of multiple diffusion is discussed. The need for practical experiments for solving the effect of diffusion is pointed out. The choice of a light source and presentation unit are briefly discussed. Author

N71-35535# Forsvarets Teletekniska Lab, Stockholm (Sweden).
MAXIMUM ACCEPTABLE SWEEP RATES FOR ANALYSIS OF RANDOM VIBRATION [MAXIMALT GODTAGBAR SVEPHASTIGHET VID ANALYS AV RANDOMVIBRATION]
Olle Bjoerklund Mar. 1970 27 p In SWEDISH; Appendix in ENGLISH
(FTL-A-A1009-15) Avail: NTIS

An investigation into the types of error which occur in the spectral analysis of random vibration with scanning filters is summarized. The size of error in scanning rates, due to the combined effects of the integration time and scanning rate is discussed. The error results in a smoothing and displacement of peaks and valleys in the spectrum. A diagram for the practical determination of the error size is presented together with a method for planning the scanning analysis in order to minimize the time necessary for analysis. Author

N71-35536# White Sands Missile Range, N. Mex. Instrumentation Development Div.
SPECIFICATION AND TEST PROCEDURE FOR A HIGH PERFORMANCE CINETHEODOLITE Final Report
Lowell D. Yates Jun. 1971 92 p
(AD-726379; STEWS-ID-I-71-3) Avail: NTIS CSCL 17/8

The report specifies the performance of a new state-of-the-art high performance cinetheodolite capable of 2-arc-seconds dynamic pointing accuracy. The feasibility of manufacturing a cinetheodolite to this specification was established by means of static and dynamic testing of a breadboard instrument. The detailed procedure to test instrument performance and determine manufacturer compliance was established. Author (GRA)

N71-35537# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ABOUT GRADATION CHARACTERISTICS OF BLACK-AND-WHITE IMAGE DURING OPTICAL PRINTING
L. P. Kaylov et al 15 Mar. 1971 21 p refs Transl. into ENGLISH from Tekhn. Kino i Televideniya (Moscow), no. 4, 1970 p 38-43
(AD-726597; FTD-MT-24-327-70) Avail: NTIS CSCL 14/5

Requirements have been formulated for the basic indexes of gradation characteristics of a duplicate of the 35-mm usual variant of wide screen film. Gradation characteristics are obtained of image obtained by optical printing under conditions of illumination of film negative by directed light; by optical printing under conditions of illumination of film negative by scattered light; and by contact printing. The possibility is indicated of the approach of gradation characteristics of images obtained with optical printing under conditions of illumination of

negative by scattered light and with contact printing.
Author (GRA)

N71-35538# Ohio State Univ. Research Foundation, Columbus.
SOME NEW ASPECTS ON HOT-WIRE ANEMOMETRY LEADING TO A SPECIAL CALIBRATION METHOD FOR HOT-WIRE PROBES, SEPTEMBER 1969 - JANUARY 1971
Richard E. Rosenberg Mar. 1971 67 p refs
(Contract F33615-67-C-1758)
(AD-727049; ARL-71-0038) Avail: NTIS CSCL 14/2

Based on a more precise treatment of the theory of hot-wire anemometry the customary King's law relationship is questionable for practical hot-wire measurements. King's law may be extended theoretically by an additional velocity dependent term, which would take care of all influences appearing with practical hot-wires (nonuniform temperature and nonuniform wire thickness over the wire length as well as influences from the coating materials on the wire ends and from the supporting prongs.) A calibration method for hot-wire probes has been developed, and calibration data obtained with the new method have been sifted to find the true exponent n relationships. Correlation among the seemingly contradictory results obtained for the exponent n by different authors is examined. GRA

N71-35539# Air Force Cambridge Research Labs., Bedford, Mass.
FIELD TEST OF A FORWARD SCATTER VISIBILITY METER
Wayne S. Hering, H. Stuart Muench, and H. Albert Brown 26 May 1971 20 p ref
(AD-726995; AFCRL-71-0315; AFCRL-ERP-356) Avail: NTIS CSCL 14/2

Field tests of a forward scatter visibility instrument were carried out in August 1970 at Cutler, Maine. The performance characteristics of the new instrument were examined through comparisons of simultaneous measurements of atmospheric extinction coefficient with a conventional transmissometer and through comparisons with human observations of visibility. During periods of dense coastal advection fog, which restricted visibility to less than one mile, the correlations coefficient between forward scatter and transmissometer measurements was about 0.91 with a standard error of estimate of 26 percent. The disparities between simultaneous measurements were caused primarily by high frequency fluctuations in fog density that were detected by the small volume measurements with the forward scatter instrument, but were smoothed out by the measurements of transmittance over a baseline of 500 ft. Additional comparisons of forward scatter measurements and transmittance measurements in winter snow situations gave results similar to those obtained in fog conditions. Author (GRA)

N71-35540 National Lending Library for Science and Technology, Boston Spa (England).
RECEIVING FUNCTION OF TWO ANTENNA RADIOMETER FOR LOCALIZING AND TRACKING SMALL RADIATING OBJECTS
K. Kunzi 1 Jun. 1971 12 p refs Transl. into ENGLISH from Arch. Elek. Uebertrag. (West Ger.), v. 24, no. 4, Apr. 1970 p 194-198
(NLL-PORS-Trans-2767-(9022.81)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

A radiometer equipped with two antennas having slightly diverging beams can be used to localize small radiating objects. The two antennas are alternately switched to the receiver input and the difference of the antenna temperatures is measured. This method can be compared with sequential lobing and monopulse of radar engineering. The calculation of the antenna response patterns for different divergence angles is carried out for radiating point sources and homogeneously radiating quadratic surfaces, and the results are compared with measurements. The possibility of localizing small radiating objects is investigated and demonstrated for a few examples. Author

N71-35541 Department of Energy, Mines and Resources, Ottawa (Ontario). Earth Physics Branch.
A SOLID STATE ELECTRICAL RECORDING MAGNETOMETER
D. F. Trigg, P. H. Serson, and P. A. Camfield 1971 18 p refs Publ. of the Earth Phys. Branch vol. 41, no. 5
Copyright. Avail: Issuing Activity

A solid-state, three-axis recording magnetometer using fluxgate-type magnetic detectors is described. Design theory, circuit details, performance data and operating instructions are provided. Instrument specifications include an output sensitivity of 1 volt per 100 gammas, a -3 db gain roll-off at 3.5 Hz and less than 4 watts power consumption. A comparison of instrument performance when using tuned magnetic detectors with performance when using untuned detectors indicates the superiority of the latter mode of operation. Author

N71-35542 Department of Energy, Mines and Resources, Ottawa (Ontario). Earth Physics Branch.
PROBLEMS IN THE DEVELOPMENT OF A MIRROR TRANSIT TELESCOPE AT OTTAWA
R. W. Tanner 1971 6 p refs *Its* Publ. of the Earth Phys. Branch, v. 41, no. 8
Copyright. Avail: NTIS

In order to assist other observatories working on improvements in meridian circle techniques, some of the difficulties encountered at the Dominion Observatory in its Mirror Transit Circle program are described. Some satisfactory aspects of the design, applicable perhaps to other instruments, are noted. An outline is given of the circumstances leading to abandonment of the project. Author

N71-36294*# General Dynamics/Convair, San Diego, Calif.
PRODUCTION OF MOTION PICTURES OF A CONTINUOUSLY DEFORMING STRUCTURE USING NASTRAN
Robert J. Reynolds *In* NASA. Langley Res. Center NASTRAN: Users Experiences Sep. 1971 p 647-657 ref (See N71-36253 22-32)
Avail: NTIS HC $9.00/MF $0.95 CSCL 14E

N71-36237# Academy of Sciences (USSR), Moscow.
A METHOD OF PHOTOGRAPHING WEAK IMAGES OF ARTIFICIAL EARTH SATELLITES
A. M. Lozinskiy *In* Polish Acad. of Sci. Observations of Artificial Earth Satellites, no. 9, 1969 1970 p 323-325 In RUSSIAN; ENGLISH summary (See N71-36206 22-31)
Avail: NTIS

N71-36238# Academy of Sciences (USSR), Moscow.
NEW SOVIET CAMERAS FOR OBSERVING ARTIFICIAL EARTH SATELLITES
K. Lapushka *In* Polish Acad. of Sci. Observations of Artificial Earth Satellites, no. 9, 1969 1970 p 327-348 In RUSSIAN; ENGLISH summary (See N71-36206 22-31)
Avail: NTIS

N71-36239# Czechoslovak Academy of Sciences, Prague.
CALCULATION OF PARAMETERS FOR THE OPERATION OF A ZEISS CAMERA
G. Karsky *In* Polish Acad. of Sci. Observations of Artifical Earth Satellites, no. 9, 1969 1970 p 349-354 refs In RUSSIAN; ENGLISH summary (See N71-36206 22-31)
Avail: NTIS

N71-36240# Bulgarian Academy of Science, Sofia.
A NEW METHOD OF PHOTOMETRIC OBSERVATION OF ARTIFICIAL EARTH SATELLITES USING THE SPIN PROGRAM
R. Radkov *In* Polish Acad. of Sci. Observations of Artificial Earth Satellites, no. 9, 1969 1970 p 355-359 refs In

RUSSIAN; ENGLISH summary (See N71-36206 22-31)
Avail: NTIS

N71-36244# Deutsche Akademie der Wissenschaften zu Berlin (East Germany).
PLOTTING PHOTOGRAPHIC SATELLITE TRANSITS BY THE LOSINSKY AND ILL METHODS FROM MEASUREMENTS MADE BY A SINGLE STATION [BETRACHTUNGEN UEBER AUSWERTUNGEN FOTOGRAFISCHER SATELLITENPASSAGEN MIT HILFE DER METHODEN LOSINSKY UND ILL AUS VERMESSUNGEN EINER STATION]
E. Penzel *In* Polish Acad. of Sci. Observations of Artificial Earth Satellites, no. 9, 1969 1970 p 391-396 In GERMAN; RUSSIAN and POLISH summaries (See N71-36206 22-31)
Avail: NTIS

N71-36473# Paris Univ. (France). Lab. of Oceanographic Physics.
GENERAL ASPECTS OF UNDERWATER PHOTOMETRIC MEASUREMENTS [GENERALITES SUR LES MESURES PHOTOMETRIQUES SOUS-MARINES]
Prieur *In* Assoc. Franc. pour l'etude et le Develop. des Appl. de l'Energie Solaire Meas. of Solar Energy in Ocean Waters and Ocean Productivity 23 May 1970 14 p In FRENCH (See N71-35472 22-13)
Avail: NTIS

N71-36474# Paris Univ. (France). Lab. of Oceanographic Physics.
DIFFERENT UNDERWATER PHOTOMETERS USED AT THE LABORATORY OF OCEANOGRAPHIC PHYSICS OF THE FACULTY OF SCIENCES OF PARIS [LES DIVERS PHOTOMETRES SOUS-MARINS UTILISES AU LABORATOIRE D'OCEANOGRAPHIE PHYSIQUE DE LA FACULTE DES SCIENCES DE PARIS]
Boutler *In* Assoc. Franc. pour l'Etude et le Develop. des Appl. de l'Energie Solaire Meas. of Solar Energy in Ocean Waters and Ocean Productivity 23 May 1970 22 p In FRENCH (See N71-35472 22-13)
Avail: NTIS

N71-36172# Observatoire de Marseille (France).
FLEXURE OF THE 3.60 m MIRROR AT THE EUROPEAN SOUTHERN OBSERVATORY [SUR LA FLEXION DU GRAND MIRROR DE 3,60 M DE EUROPEAN SOUTHERN OBSERVATORY]
G. Lemaitre *In* European Southern Obs. European Southern Obs. Bull. No. 8 Jun. 1971 p 21-31 refs In FRENCH (See N71-36170 22-30)
Avail: NTIS

15 MACHINE ELEMENTS AND PROCESSES

Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control, and reliability; drafting; and materials fabrication, handling, and inspection.

N71-35643*# Martin Marietta Corp., Orlando, Fla.
STUDY PROGRAM OF NASA/GSFC WELD QUALITY MONITOR SYSTEM Quarterly Report, Apr. - Jun. 1971
Wendell R. Hutchinson 8 Jul. 1971 35 p
(Contract NAS5-21395)
(NASA-CR-121853; OR-11292) Avail: NTIS CSCL 13E

The weld quality monitor has been used with a recent model solid state power supply to evaluate ability to differentiate between sound and defective weld joints. The monitor has been evaluated on Dumet/nickel ribbon welded joints used in microelectronic module fabrication. Distinct separation was achieved between low strength welds and sound welds by the quality monitor. Evaluations indicate a drift level at less than 2 percent on a series of 50 consecutive welds. Author

N71-35644*# Rensselaer Polytechnic Inst., Troy, N.Y.
DESIGN OF A TOROIDAL WHEEL FOR A MARTIAN ROVING VEHICLE
Richard Lawrence Simon May 1971 156 p refs
(Grant NGL-33-018-091)
(NASA-CR-122036; RPI-TR-MP-21) Avail: NTIS CSCL 13I

A toroidal multihoop metal elastic wheel is proposed for use on a Martian roving vehicle. This nonpressurized wheel is composed of circular metal elastic hoops rigidly connected to the hub and hinge jointed to the rim. The unique design offers excellent flexibility in the normal, transverse, and lateral directions. To predict the deflection characteristics of the toroidal wheel, extensive mathematical analysis was performed and then the results implemented in the form of computer programs. One such computer program aids in the synthesis of scaled down and full size wheels according to the theory of deformable bodies. Another program analyzes toroidal wheels of various dimensions and number of hoops for their deflection characteristics and internal force structure when subjected to a particular loading condition. The construction of both scaled down and full size toroidal wheels is also discussed. Author

N71-35645*# Kentucky Univ., Lexington. Dept. of Metallurgical Engineering and Materials Science.
THE ROLE OF ANIONS IN MECHANICAL FAILURE
Martin H. Leipold and Cawas M. Kapadia Aug. 1971 48 p refs
(Grant NGL-18-001-042)
(NASA-CR-121937; UKY-42-71-MET 14; AR-2) Avail: NTIS CSCL 20K

Property studies of MgO include fabrication, grain growth, microhardness and diffusion. Results involving fabrication of MgO in the presence of anions indicate that sulfur and chlorine are very detrimental to the densification process, apparently by formation of volatile gas products. Fluorine and hydroxyl have slightly detrimental effects, although not as severe as the sulfur and chlorine. Grain growth studies indicate these anion impurities do not inhibit grain growth; specimens containing porosity exhibited grain growth rates comparable to those found with pore-free undoped materials. Microhardness and chemical analysis suggest that the solubility of chlorine and sulfur in MgO is extremely low, while fluorine and hydroxyl may remain in the specimens during exposure to high temperatures at more substantial levels. Author

N71-35646*# Monsanto Research Corp., Dayton, Ohio.
THERMALLY RESISTANT POLYMERS FOR FUEL TANK SEALANTS Annual Summary Report, 1 Jul. 1970 - 28 Jun. 1971
James A. Webster and Thomas J. Morrow Jul. 1971 79 p refs
(Contract NAS8-21401)
(NASA-CR-119940; ASR-3; MCR-DA-301) Avail: NTIS CSCL 11A

The development of imide, isocyanate, and siloxane linked fluorocarbon polymers for use as sealants in fuel tanks of advanced high speed aircraft is described. Synthesis and polymerization of polymer intermediates representing perfluoro alkylene and perfluoro alkylene ether segments and amine, isocyanate, or silyl groups are discussed. Polymer evaluations including thermal and oxidative stability, fuel resistance, and stress corrosion of a titanium alloy are discussed. Author

N71-35547# Grumman Aerospace Corp., Bethpage, N.Y. Materials and Structural Mechanics Section.
DEVELOPMENT OF BETA-SPODUMENE CLOSED PORE INSULATION (CPI)
T. S. Stanislaw Sep. 1971 35 p refs
(RM-517) Avail: NTIS

An investigation was conducted to develop a refractory (2300 F) waterproof external insulation for the earth orbiting shuttle (EOS). Using beta-spodumene as the matrix material, both organic (fugitive) and inorganic pore formers, as well as foaming by means of chemical reaction and the use of a surfactant, were tried over a wide range of compositions, processing conditions, and geometries to obtain the desired properties. When pore formers were used, properties obtained on specimens less than 1 inch in diameter were not duplicated on larger sized specimens. Foams were weak, difficult to handle, and exhibited migration to the surface of what is believed to be binder material and other additives. A material was not obtained that possessed all of the desired properties. Author

N71-35548# National Research Council of Canada, Ottawa (Ontario).
DETERMINATION OF STRAINS DURING CUTTING [K VOPROSU OPREDELENIYA DEFORMATSII PRI REZANII]
P. D. Bespakhotnyi et al 1971 7 p refs Transl. into ENGLISH from Izv. Vysshikh Uchepn. Zavendenii Mashinostr. (Moscow), no. 8, 1967 p 140-142
(NRC-TT-1471) Avail: NTIS

A description is given of a method to calculate the components of the strain deviator based on calculations of strain rates and particle velocities in the cutting zone. The process involves filming the chip formation during free cutting of specimens to obtain a clear picture of the qualitative change in the strained state of material in the zone of cutting. The equations of particle trajectories on conversion to a chip make it possible to find the velocities of particles and the rate of change in the strains along these trajectories. The method was verified by experimentally cutting steel 45. Author

N71-35549# National Research Council of Canada, Ottawa (Ontario).
SOME ASPECTS OF MECHANICS OF CUTTING HARD-TO-MACHINE MATERIALS [NEKOTORYE VOPROSY MEKHANIKI REZANIYA TRUDNOOBRABATYVAEMYKH MATERIALOV]
P. D. Bespakhotnyi et al 1971 10 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii Mashinostr. (Moscow), no. 2, 1967 p 111-115
(NRC-TT-1470) Avail: NTIS

A description is given of a method to study strained and stressed states in the zone of cutting. Use is made of the main tenets of the theory of plastic flow. The results of experimental determinations of strain rates on cutting heat resistant EI-437B alloy are described. The procedure may serve as a starting point in the development of a method for quantitative evaluation of strains and stresses in the cutting zone. Author

N71-35550*# Northwestern Univ., Evanston, Ill.
ISOTHERMAL ELASTOHYDRODYNAMIC THEORY FOR THE FULL RANGE OF PRESSURE-VISCOSITY COEFFICIENT
H. S. Cheng Washington NASA Sep. 1971 53 p refs
(Grant NGL-14-007-084)
(NASA-CR-1929) Avail: NTIS CSCL 11H

The isothermal, elastohydrodynamic solutions for line contacts are extended to cover the full range of pressure-viscosity parameter, G, and the region of extremely heavy loads. The effect of a composite exponential model for the pressure-viscosity dependence on the film thickness is also studied. Comparison is also made between the theoretical results and the recently obtained X-ray film thickness measurements. Author

N71-35551# Royal Aircraft Establishment, Farnborough (England).
LONGITUDINAL AND TRANSVERSE SHRINKAGE IN ELEKTRON BEAM WELDED TITANIUM PLATES [LAENGS UND QUERSCHRUMPFUNG AN ELEKTRONEN-STRAHLGESCHWEISSTEN TITANBLECHEN]
E. Webersich Jun. 1971 15 p Transl. into ENGLISH from German report
(RAE-Lib-Trans-1555; DVS-5) Avail: NTIS

A simple method is described for the determination of longitudinal and transverse shrinkage. The longitudinal shrinkage for Ti-13V-11Cr-3Al was determined as 0.5 mm/m of weld seam. This value, which would be relatively high for steel, is explained by the lower elastic modulus of the titanium alloy. The transverse shrinkage was determined in the center to be approximately 3.8%, which corresponds to a value of 0.065 mm for a weld width of 1.66 mm. The whole transverse shrinkage occurs in the fusion zone. The region near the weld seam is extended. Author

N71-35552# Research Inst. of National Defence, Stockholm (Sweden).
PART REPORT CONCERNING DEVELOPMENT OF A PNEUMATICALLY DRIVEN ELBOW JOINT AND AN ELECTRICALLY CONTROLLED PNEUMATIC VALVE (SVEN PROJECT 2) [DELRAPPORT BETRAEFFANDE UTVECKLING AV PNEUMATISKT DRIVEN ARMBAGSLED OCH ELEKTRISKT STYRD PNEUMATISK VENTIL (SVEN-PROJEKT 2)]
C. Johansson, Th. Persson, and E. Ulen Jan. 1970 89 p refs In SWEDISH
(FOA-2-C-2363-54) Avail: NTIS

An electrically controlled valve system for pulsed operation of a pneumatically powered prosthesis is described. The valve system requirements are discussed. In this connection an outline is given of the development now under way for an elbow joint system which has been selected as a first application of the valve. Finally, the construction of the valve and its electronic control circuits are briefly explained. Preliminary data is submitted for a function testing prototype to serve as a forerunner of the first generation of the valve. In addition a description is given of an electropneumatic locking mechanism. Author

N71-35553# Technische Hochschule Munchen (West Germany). Fakultaet fuer Maschinenwesen und Elektrotechnik.
A CONTRIBUTION TO THE MECHANICAL DYNAMIC TESTING OF LOW TEMPERATURE BEHAVIOR OF LUBRICATING GREASES FOR ROLLER BEARINGS [EIN BEITRAG ZUR MECHANISCH-DYNAMISCHEN PRUEFUNG DES TIEFTEMPERATURVERHALTENS VON SCHMIERFETTEN FUER WAELZLAGER]
Hans-Dieter Lentrodt (Ph.D. Thesis) 1971 115 p refs In GERMAN
Avail: NTIS

The physical and chemical properties of lubricants used with roller bearings under low temperature conditions are discussed. The test equipment is described and the results of the tests are presented in tables and graphs. Author

N71-35554# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
RELIABILITY OF HYDRAULIC SYSTEMS
A. A. Komarov 22 Mar. 1971 285 p refs Transl. into ENGLISH of the book "Nadezhnost Gidravlicheskikh System" Moscow, Machinebuilding Publishers, 1969 p 1-236
(AD-726579; FTD-HC-23-636-70) Avail: NTIS CSCL 13/7

The book is a compilation of the principles of the theory of reliability of hydraulic systems. The author demonstrates the use of statistical methods in arriving at reliability characteristics; describes the characteristic flaws of hydraulic systems and their causes; analyzes the operational conditions of hydrosystem elements and rapid methods for determining the longevity of

such elements, with due allowance for day-to-day working conditions; and presents the results of laboratory tests run on a number of plant units, as well as reliability indices of hydraulic systems. Author (GRA)

N71-35555# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INCREASING THE WEAR RESISTANCE OF PARTS OF SLURRY PUMPS
V. E. Fedorchenko et al 5 Feb. 1971 14 p refs Transl. into ENGLISH from Tek. Tek. Obogashch. Uglei (USSR), v. 5, 1968 p 280-287
(AD-726595; FTD-MT-23-890-70) Avail: NTIS CSCL 13/11

Laboratory and inplant tests conducted at beneficiation plants of the Donbas confirmed that the parts of slurry pumps cast from an Ich Kh28 N2 alloy containing C 2.4, Si 0.89, Mn 0.51, Cr 34.5, Ni 3.16, and P 0.08 percent (Brinell hardness no. 444-77) exhibited a higher wear resistance than parts made of 5 other alloys tested. The service life of parts made of the Ich Kh28 N2 alloy was 15 times longer than that of parts made of grade SCh15-32 gray cast iron. It is recommended that precision casting be employed to eliminate mech. treatment.
Author (GRA)

N71-35556# Northwestern Univ., Evanston, Ill. Dept. of Mechanical Engineering and Astronautical Sciences.
THERMOELASTIC INSTABILITY OF FRICTIONAL CONTACTS Final Report, 1 Apr. - 30 Sep. 1970
Ralph A. Burton and Thomas A. Dow Jun. 1971 41 p refs
(Contract N00014-67-A-0356-0013)
(AD-726444; Rept-5341-410) Avail: NTIS CSCL 13/9

The report is a study of the stability of frictional contact of elastic solids. To be specific, the problem is to determine when surface pressure or temperature distributions will be damped, or when they will be amplified by the thermal, frictional and elastic interactions of the surfaces. This effort will shed light on the behavior of numerous lubricated and unlubricated sliding systems such as seals, bearings, and piston rings. It should lead to design criteria in terms of materials and operating parameters. The present report is concerned with two phases of the study, a discrete model of surface contact, and a continuous thin-blade model of surface contact. The first sheds light on the processes at work, and analysis of it leads to a thermal vibration equation with a damping coefficient which may be either negative or positive depending upon the specific operating conditions. The second model provides a more complete treatment of the thermoelastic interactions at work in continuous bodies.
Author (GRA)

N71-35557# Stevens Inst. of Tech., Hoboken, N.J. Davidson Lab.
STUDIES OF DUAL AND TANDEM RIGID WHEEL PERFORMANCE IN SAND Final Report
Gary D. Swanson Jun. 1971 132 p refs
(Contract DAAE07-69-C-0358)
(AD-726384; SIT-DL-71-1536) Avail: NTIS CSCL 13/6

Tests were conducted with five pair of wheels, three of which were geometrically similar. Four loads and three spacings were tested for each wheel pair. A dimensional analysis approach was utilized to develop general functional relationships for sinkage and motion resistance (tow force). Test data was analyzed and specific equations were developed for prediction of sinkage and resistance to motion for wheels in dual and tandem configuration. The resulting equations were compared with equations developed or discussed by Bekker. Single wheel tests were conducted and comparisons made between single wheel performance and dual or tandem wheel performance.
Author (GRA)

N71-35558# Army Test and Evaluation Command, Aberdeen Proving Ground, Md.
TOOLS, AVIATION Final Report
1 Jul. 1971 38 p
(AD-726893; MTP-7-2-057) Avail: NTIS CSCL 13/9

The procedure provides techniques for evaluating hand tools used in support of aircraft maintenance. Author (GRA)

N71-35559# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ELECTRODIFFUSION WEAR OF TOOLS AND HOW TO COMBAT IT
V. A. Bobrovskii 15 Apr. 1971 124 p refs Transl. into ENGLISH of the book "Elektro-diffuzionnyy Iznos Instrumenta i Borba s nim" Moscow, Moskouskiy Rabochiy, 1969 p 1-102
(AD-726804; FTD-MT-24-310-70) Avail: NTIS CSCL 13/9

The book is devoted to the problem of the effect of thermoelectric currents, which arise during the processing of metals by cutting, on the durability of cutting tools. The author tells about the results of numerous experiments which provide a clear impression of the mechanism of the influence of thermoelectric currents on the wear of tools. It describes the devices for various machines as well as the design of the glued tools, the layer of glue of which impedes the effect of the thermoelectric currents. Results of the research conducted by the author on various glues are presented and the technology of gluing machine-tool devices and parts of machine-tool devices and parts of machine tools with an elastometer of brand GEN-150 is described. The author advances his hypothesis about electrodiffusion wear during cutting and rubbing. GRA

N71-35560 National Lending Library for Science and Technology, Boston Spa (England).
ORGANIC ADDITIONS AND DETERMINATION OF PRODUCTS OF THEIR CONVERSION IN ELECTROLYTES DURING ELECTRODEPOSITION OF METALS. 1: DETERMINATION OF BENZAMIDE, SACCHARIN AND O-TOLUENESULPHONAMIDE DURING THEIR COMBINED PRESENCE IN NI-PLATING ELECTROLYTES
D. Mockute et al 17 Mar. 1971 8 p refs Transl. into ENGLISH from Liet. TSR Mokslu Akad. Darbai, Ser. B (Lithuania), v. 60, no. 1, 1970 p 149-152 In ENGLISH and RUSSIAN
(NLL-LTI-746-725-(9022.401); LTI-734-5832) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The desulphidization and reduction of saccharin to o-toluenesulphonamide from nickel plating electrolytes during the electrodeposition of Ni at pH = 4.6 was investigated. An extraction chromatographic method was devised for determining the products of saccharin conversion and an extraction spectrographic method was devised for determining the saccharin, benzamide and o-toluenesulphonamide concentrations during their joint presence in the electrolyte. J.G.M.

N71-35561 National Lending Library for Science and Technology, Boston Spa (England).
INVESTIGATION OF PROCESS OF CHEMICAL AND ELECTROLYTIC DEPOSITION OF STABLE COPPER LAYER ON SURFACE OF STAINLESS STEEL
I. V. Krotov et al 17 Mar. 1971 11 p refs Transl. into ENGLISH from Zh. Prikl. Khim. (USSR), v. 43, no. 7, Jul. 1970 p 1496-1500 In ENGLISH and RUSSIAN
(NLL-LTI-746-731-(9022.401); LTI-737-9837) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

Methods for depositing metal coatings are discussed with emphasis on the deposition of copper on stainless steel are discussed. Using the recommended technique a copper layer about 30 microns thick formed on components and samples with good adhesion to the stainless steel. The copper layer was not separated from the stainless steel surface even after two hours exposure to a hydrogen atmosphere at 980 C. Author

N71-35562 National Lending Library for Science and Technology, Boston Spa (England).
ELECTRODEPOSITION OF PALLADIUM FROM AMINO-

PALLADIUM HYDROXIDE, SULPHAMATE AND BROMIDE ELECTROLYTES
I. F. Kushevich et al 17 Mar. 1971 10 p refs Transl. into ENGLISH from Zashch. Metal. (USSR), v. 6, no. 4, 1970 p 465-469 In ENGLISH and RUSSIAN
(NLL-LTI-746-732-(9022.401); LTI-737-9767) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The electrodeposition of palladium from sulfamate, bromide, and amino-palladium electrolytes was investigated. Electrolyte preparation techniques are outlined and the results are discussed. J.M.

N71-35583 National Lending Library for Science and Technology, Boston Spa (England).
CONSIDERATIONS ON THE NATURE AND STRENGTH OF BOLTED JOINTS
H. Wiegand et al 11 May 1971 25 p refs Transl. into ENGLISH from Maschinenschaden (Munich), v. 42, no. 4, 1969 p 103-112
(NLL-CE-Trans-5406-(9022.09)) Avail: Natl. Lending Library, Boston Spa, Engl.: 3 NLL photocopy coupons

Materials, manufacture and quality standards for bolted joints and their stability under static and dynamic stresses are discussed. Methods of calculating and securing bolts and the special problem of bolts subject to additional stresses such as corrosion and high temperatures are presented. Author

N71-35584 National Lending Library for Science and Technology, Boston Spa (England).
ORGANIC ADDITIONS AND DETERMINATION OF PRODUCTS OF THEIR CONVERSION IN ELECTROLYTES DURING ELECTRODEPOSITION OF METALS. 2: DETERMINATION OF BUTINDIOL, SACCHARIN AND PHTHALIMIDE DURING THEIR COMBINED PRESENCE IN ELECTROLYTES OF BRIGHT NICKEL PLATING
D. Mockute et al 17 Mar. 1971 10 p refs Transl. into ENGLISH from Liet. TSR. Mokslu Akad. Darbai, Ser. B (Lithuania), v. 60, no. 1, 1970 p 153-157 In ENGLISH and RUSSIAN
(NLL-LTI-746-726-(9022.401); LTI-734-6833) Avail: Natl. Lending Library, Boston Spa, Engl., 1 NLL photocopy coupon

A bright nickel plating electrolyte, containing butindiol, saccharin, and phthalimide, was analyzed to determine the concentrations of organic additions. The saccharin and phthalimide concentrations were determined spectrophotometrically. Calibration curves were constructed for saccharin at lambda = 280 and 30 microns and for phthalimide at lambda = 300 microns. A titrimetric determination of saccharin was also conducted. The butindiol concentration was determined polarographically in the absence of conversion products and by bromination according to the Rosamund method. J.G.M.

N71-35585 National Lending Library for Science and Technology, Boston Spa (England).
CONTEMPORARY STATE OF THEORY OF JOINT DISCHARGE OF IONS ON CATHODE
A. L. Rotinyan et al 17 Mar. 1971 12 p refs Transl. into ENGLISH from Tsvetn. Metal. (Moscow), v. 43, no. 4, Apr. 1970 p 28-32 In RUSSIAN and ENGLISH
(NLL-LTI-746-663-(9022.401); LTI-737-8863) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

In improving the electrolyte refining of metals with a given degree of purity, a paramount role is played by the dependencies, characterizing the content of admixtures in the deposit on their concentration in the solution, current density, temperature, composition of the electrolyte, and other factors. With the use of formulas and the basic equation of the kinetics of the electrode reactions, the determination of the quantitative laws of joint discharge of ions under conditions of electrolytic winning of pure metals is possible. The nature of the laws was determined by the character of polarization of the basic metal and metal-admixture. A.L.

N71-35586 National Lending Library for Science and Technology, Boston Spa (England).
ELECTRODEPOSITION OF PALLADIUM FROM ALKALINE AMMONIUM CHLORIDE ELECTROLYTE
L. Siauruksite 17 Mar. 1971 13 p refs Transl. into ENGLISH from Lietuvos TSR Mokslu Akad. Darbai: Ser B (Vilnius), v. 61, no. 2, 1970 p 39-45 In RUSSIAN and ENGLISH
(NLL-LTI-746-759-(9022.401); LTI-734-6561) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The electrodeposition of palladium coatings of increased corrosion resistance from ammonium chloride electrolyte is discussed. Investigations of the electrodeposition properties were conducted using a rotating disc electrode and a temperature kinetic method. The cathodic reactions and the nature of polarization depending on the value of the cathodic potential are reported. Author

N71-35587 California Univ., Berkeley.
A FUNDAMENTAL STUDY OF THE PRESSURE WELDING OF DISSIMILAR METALS THROUGH OXIDE LAYERS
Wesley Dale Ludemann (Ph.D. Thesis) 1969 316 p
Avail: Univ. Microfilms Order No. 70-17610

Four dissimilar metal combinations were welded: iron-copper, iron-aluminum, beryllium-aluminum, and beryllium-copper. Welds were made with sanded surfaces and with oxidized surfaces. The thin oxide films residual on sanded surfaces were usually dissipated during welding, and, where metals did not react to form brittle phases, welds were made which exceeded the strength of the weaker metal of the pair. Strong welds were also made at temperatures too low to disperse residual oxides, but the welds were not as strong as the metals. Welds made between metals which reacted to form brittle phases failed either within the brittle phase or at a plane of voids caused by unequal diffusion of the two metals. Strong welds were made through thick layers of interfacial oxides which were not dispersed during welding. The strength of the welds was limited by the strengths of the oxide layers, or by the amount or strength of bonding between the oxides and one of the metals. Under welding conditions where reaction occurred between sanded metals, the presence of interfacial oxides generally improved weld strength. Dissert. Abstr.

N71-35643# Joint Publications Research Service, Washington, D.C.
ELECTRON BEAM WELDING OF ZIRCONIUM CARBIDE AND NIOBIUM CARBIDE ELECTRODES TO STAINLESS STEEL
N. A. Olshanskiy et al *In its* Mater. for MHD Generator Channel 31 Aug. 1971 p 191-198 refs (See N71-35621 22-18)
Avail: NTIS

N71-35644# Joint Publications Research Service, Washington, D.C.
PRODUCTION OF BORON SILICIDES AND ANALYSIS OF THEIR ELECTRICAL CONDUCTIVITY
L. B. Lutnova et al *In its* Mater. for MHD Generator Channel 31 Aug. 1971 p 199-203 refs (See N71-35621 22-18)
Avail: NTIS

16 MASERS

Includes applications of masers and lasers. For basic research see: 26 Physics, Solid State.

N71-35568# Research Inst. of National Defence, Stockholm (Sweden).
ATTENDANCE AT A SYMPOSIUM ON ULTRASHORT LIGHT PULSES AND THEIR INTERACTION WITH MATTER, IN BERN 28-30 JULY 1969 [DELTAGANDE I

SYMPOSIUM ON ULTRASHORT LIGHT PULSES AND THEIR INTERACTION WITH MATTER, IN SERN 28-30 JULI 1969]
Tore Bergqvist and Robert Nilsson Mar. 1971 24 p refs In SWEDISH
(FOA-2-C-2373-51) Avail: NTIS

The proceedings of a symposium on lasers with extremely short light pulses and their interaction with matter are presented. Some of the problems concerning the storage of energy for transient release and some applications of interest in laser physics are described. Author

N71-35569# Research Inst. of National Defence, Stockholm (Sweden).
INVESTIGATION INTO THE DAMAGING EFFECT OF RUBY LASER BEAMS ON THE MIRROR COATING OF A SIGHTING PRISM [UNDERSOEKNING AV RUBINLASER-STRALENS SKADEVERKAN PA SPEGELBELAEGGNINGEN HOS ETT SIKTESPRISMA]
Nils Eric Sandberg Jan. 1970 10 p In SWEDISH
(FOA-2-A-2520-51) Avail: NTIS

The mirror coating on a sighting prism has been exposed to radiation from four different commercial ruby laser range finders whose pulse energy has been measured calorimetrically. Visible damage was found after a large number of laser pulses of power density approximately 1 mega watt per square centimeter. Author

N71-35570# Army Weapons Command, Rock Island, Ill. Research Development and Engineering Directorate.
HOLOGRAPHIC TESTING TECHNIQUES
Robert J. Iversen, Roger D. Schulz, and Ronald G. Arnold Jun. 1971 38 p refs
(AD-726369; AMSWE-RE-71-32) Avail: NTIS CSCL 14/2

Applications of holographic interferometry to vibration analysis, composite component evaluation, and precision cylinder inspection developed under In-House Laboratory Independent Research funding in the Research Directorate, Weapons Laboratory at Rock Island are presented. Stroboscopic holography is compared with time-average holography, and typical results are presented. The results of the holographic inspection of molded graphite/epoxy composites and honeycomb panels are reported. A technique for the comparison of the internal radial dimensions and straightness of precision cylinders such as gun barrels is described along with typical results. Author (GRA)

N71-35571# ILC, Inc., Sunnyvale, Calif.
OPTICAL PUMPS FOR ERBIUM LASERS Triannual Report No. 2, 1 Nov. 1970 - 1 May 1971
Lowell Noble Jun. 1971 50 p refs
(Contract DAAB07-70-C-0296)
(AD-726391; ECOM-0296-2) Avail: NTIS CSCL 20/5

The objective of this program is to produce more efficient plasma pumps for pulsed Er:glass lasers. Lamps using both noble gas (xenon) and alkali vapor plasmas are being investigated. Three glass and one YAG laser material have been selected for testing. Emission spectra of lamps are being measured and the excitation spectra and other optical properties of the laser materials are being examined as a basis for further improvement in lamp-laser energy transfer. Pumping effectiveness of the lamp-laser material combinations are being compared and overall laser efficiencies are being measured. Thirty-six xenon lamps have been constructed and tested in order to determine the effects of varying pulse length, pulse energy, bore diameter, and fill pressure of xenon lamps on the fluorescent light output of several Er:glass and Er, Yb:YAG laser materials. Twelve alkali vapor lamps were constructed, and pumping effectiveness measurments were made as a function of several lamp parameters. Author (GRA)

N71-35572# Ballistic Research Labs., Aberdeen Proving Ground, Md.
A HOLOGRAPHIC METHOD TO MEASURE SCINTILLATION EFFECTS
Paul H. Deitz and John M. Evans Jan. 1971 16 p refs
(AD-726902; BRL-TN-1745) Avail: NTIS CSCL 20/6

A method is described by which a wave front reconstruction technique is utilized to record the effects of a turbulent medium on the propagation of optical beams. By this technique both amplitude and phase information in a two-dimensional cross section of a received optical beam are recorded. The mode structure of the source is seen not to be critical in this application. Author (GRA)

N71-35573# California Univ., San Diego. Visibility Lab.
OFF-AXIS IRRADIANCE PRODUCED BY A LASER BEAM IN WATER Final Report, Sep. 1969 - May 1971
Seibert Q. Duntley May 1971 62 p
(Contract N60921-70-C-0008)
(AD-726826) Avail: NTIS CSCL 20/6

Measurements of off-axis irradiance produced by the scattering of light from a laser beam during its passage through water were made at representative off-axis angles to more than 90-degrees and to ranges greater than 20 attenuation lengths. From these data an empirical equation has been evolved by means of which scattered irradiance can be calculated at virtually any off-axis point in any kind of ocean water if the spectral volume attenuation coefficient and the spectral volume adsorption coefficient of the water are known. Author (GRA)

N71-35574# Radio Condenser Co., Camden, N.J. Advanced Technology Labs.
OPTICALLY PUMPED MASERS USING F CENTERS Final Report, 1 Feb. 1970 - 1 Mar. 1971
B. R. Feingold and G. G. Weidner Jun. 1971 51 p refs
(Contract N00014-70-C-0216)
(AD-726760) Avail: NTIS CSCL 20/5

The feasibility has been demonstrated of using F centers in potassium iodide as the crystal for a selective absorption optically pumped maser. Experiments indicate that this type of maser could operate at temperatures above 10K, frequencies up to 40 GHz, with a bandwidth of 500 MHz, and could be pumped by (GaAl)As laser diodes. An attempt to demonstrate inversion was made, but the single laser diode that was used had insufficient average power. It is recommended that (1) this work be continued using diode arrays, and (2) a small traveling wave maser be evaluated. Author (GRA)

N71-35575 Stanford Univ., Calif.
A FRESNEL DRAG LASER GYROSCOPE
Gail Austin Massey (Ph.D. Thesis) 1970 184 p
Avail: Univ. Microfilms Order No. 70-18446

A technique for determining, with high sensitivity, the orientation of the spin axis of a transparent, unmarked spherical rotor was evaluated. The method makes use of the Fresnel drag effect, whereby the rotation of the dielectric sphere produces a nonreciprocal phase shift on light refracted through the rotor. By placing the rotating sphere inside the cavity of a traveling wave ring laser, this phase shift can be measured by detecting the frequency difference or beat between the laser oscillations traveling in opposite directions. The beat frequency produced in this way is proportional to the cosine of the angle between the rotor spin axis and a normal to the plane of the ring laser. Such a device might be used as a gyrocompass if the sphere is freely suspended to act as an inertial reference, and it might also be useful as an angle measuring tool if the ring plane is taken as the reference and the rotor axis is made to change. Dissert. Abstr.

17 MATERIALS, METALLIC

Includes cermets; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see: 06 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics.

N71-35576*# New Mexico Univ., Albuquerque. Bureau of Engineering Research.
ELECTRON BEAM EVAPORATED HIGH MOBILITY THIN FILMS OF INDIUM ANTIMONIDE Final Report
T. W. Kim, V. D. Deokar, and W. W. Grannemann Jul. 1971 26 p refs
(Grant NGR-32-004-002)
(NASA-CR-120797; EE-191(71)NASA-028) Avail: NTIS CSCL 11F

The electron gun apparatus, experimental procedures, and preliminary results are described. The electron beam heated vapor source with 270 deg magnetic deflection is water cooled and is operated with a high voltage source. The electron gun is operated only when the pressure is 10 microtorr or lower, and a thickness monitor measures the deposit mass. The deposited InSb films are metallized in a second vacuum system with 0.3 to 0.5 microtorr. The films are then oxidized and recrystallized. Films deposited at substrate temperatures between 280 and 350 C were not good even in appearance. Films deposited at 250 C with slow rates of evaporation had a milky-white appearance and were uniform; after oxidation the color changed to grey. Annealing at 535 C gave a dendritic structure with a golden color, annealing again at 545 C increased Hall mobility, but further annealing decreased the mobility. Author

N71-35577*# Case Western Reserve Univ., Cleveland, Ohio. Div. of Metallurgy and Materials Science.
DEFORMATION EFFECTS ON A DISPERSION HARDENED ALLOYS Annual Status Report
J. J. Petrovic and L. J. Ebert Mar. 1971 20 p refs
(Grant NGL-36-003-094)
Avail: NTIS CSCL 11F

Creep and creep rupture properties are being investigated in the TD-nickel alloy system, in an attempt to control them by controlling the grain size of the alloy. Suitable variance of grain size and shape was established with a three-inch bar of TD-nickel starting material. The capability for elevated temperature tensile testing was established. The required experimental apparatus for creep and creep rupture testing is being completed. It will allow testing in an inert argon atmosphere at temperatures as high as 2400 F. An investigation of internal friction was initiated in order to provide independent data regarding elevated temperature creep mechanisms. Attempts to produce single crystals of TD-nickel by electron beam floating zone methods were unsuccessful. Author

N71-35578*# Lehigh Univ., Bethlehem, Pa. Office of Research
INVESTIGATION OF THE SOLIDIFICATION, STRUCTURE AND PROPERTIES OF EUTECTIC ALLOYS INCLUDING CONSIDERATION OF PROPERTIES CONTROL Progress Report, Nov. 1969 - Aug. 1971
R. W. Kraft Aug. 1971 13 p refs
(Grant NGL-39-007-007)
(NASA-CR-122043) Avail: NTIS CSCL 11F

The elevated temperature mechanical behavior of the Ni-Ni3Nb eutectic composite is investigated. Also, a study of the effect of rod size, spacing, and composition on superconducting properties of aligned Sn-In eutectic alloy, and the physical measurement of elastic moduli of unidirectional solidified eutectic composites are reported. E.M.C.

N71-35579*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
OXIDATION RESISTANT CLADDINGS FOR SUPERALLOYS
Michael A. Gedwill and Salvatore J. Grisaffe 1971 13 p refs Presented at 53D Metal Show and Mater. Eng. Congr., Detroit, 18-21 Oct. 1971; Sponsored by Am. Soc. for Metals
(NASA-TM-X-67925; E-6567) Avail: NTIS CSCL 11F

The oxidation protection afforded IN-100 and WI-52 superalloys by thin claddings of Ni-Cr-Al-Si and Fe-Cr-Al-Y alloys was examined primarily at 1090 C. Comparisons were made with commercial aluminide coatings using cyclic furnace and high velocity burner rig tests. In furnace tests, Ni-Cr-Al-Si on IN-100 and Fe-Cr-Al-Y on WI-52 performed as well or better than two aluminide coatings. Burner rig performance of the Fe-Cr-Al-Y cladding was better than that of the Ni-Cr-Al-Si cladding on IN-100 and the aluminide coating on WI-52, but less than the aluminide coating on IN-100. An aluminized Ni-Cr-Al-Si cladding performed better than any coating or cladding. Author

N71-35580*# Battelle Memorial Inst., Columbus, Ohio. Materials and Structure Div.
DEVELOPMENT OF A CHROMIUM-THORIA ALLOY
N. D. Veigel, B. A. Wilcox, J. M. Blocher, Jr., A. H. Clauer, D. A. Seifert et al 10 Mar. 1971 96 p refs
(Contract NAS3-12435)
(NASA-CR-72901) Avail: NTIS CSCL 11F

A vapor-deposition apparatus was designed, constructed, and used to prepare chromium and chromium-3 without ThO2 powders in 114 to 227 g lots. The powders were consolidated by hot isostatic pressing, rolled to sheet, and evaluated in sheet form. The addition of thoria lowered the ductile-to-brittle transition temperature both in the as-rolled and annealed (1 hr, 1200 C) conditions. After high temperature annealing (up to 1427 C), the Cr-ThO2 alloys recrystallized with elongated grains. Although such a structure should have good high temperature strength, no improvement was observed, probably because the microstructure was less than optimum. Author

N71-35581# National Research Council of Canada, Ottawa (Ontario). Div. of Chemistry.
THE INTERPRETATION OF THE HALL CONSTANT IN MONOVALENT NOBLE METALS AND THEIR ALLOYS [ZUR DEUTUNG DER HALLKONSTANTE EINWERTIGER EDELMETALLE UND IHRER LEGIERUNGEN]
D. Hagmann et al 1971 15 p refs Transl. into ENGLISH from Z. Metallk. (Stuttgart), v. 55, no. 12, 1964 p 789-793
(NRC-TT-1476) Avail: NTIS

A discussion of the Hall coefficient of pure copper, silver, gold and some silver alloys is presented based on a model for an anisotropic Fermi surface. The experimentally determined variation of the Hall coefficient of alloys can be explained, assuming an anisotropic scattering of the conduction electrons by the impurities. For this case, an equation similar to the two band formula is derived, which also explains, at least qualitatively, the observed temperature dependence of the Hall coefficient of alloys. The variation of the thermoelectric power of the silver alloys is found to be similar to that of the reciprocal Hall coefficient. Author

N71-35582# National Research Council of Canada, Ottawa (Ontario). Div. of Chemistry.
CONDUCTIVITY AND HALL CONSTANT. 32: GENERAL REMARKS CONCERNING POLYCRYSTALLINE ALLOYS OF COPPER AND SILVER WITH THE GROUP B METALS [LEITFAEHIGKEIT UND HALLKONSTANTE. 32: ALLGEMEINE BEMERKUNGEN ZU DEN MISCHKRISTALLEGIERUNGEN DES KUPFERS UND SILBERS B-METALLEN]
W. Koester et al 1971 30 p refs Transl. into ENGLISH from Z. Metallk. (Stuttgart), v. 55, no. 12, 1964 p 750-762
(NRC-TT-1474) Avail: NTIS

The influence of the addition of B elements of the third and

fifth period to copper and silver on the electrical resistivity, Hall constant, and thermoforce is summarized. In addition, the influence of 80% cold work on the formation of short range order is discussed. This property was related to the valency of the solute elements and to electron/atom ratio. Short range order leads to a decrease of resistivity and Hall constant for small solute concentrations. For higher concentrations, a change in sign was observed. The Hall constant increases at concentrations at which the resistivity is still decreasing. At still higher concentrations both values increase. Author

N71-35583# National Research Council of Canada, Ottawa (Ontario).
CONDUCTIVITY AND HALL CONSTANT. 33: DISORDERED SOLID SOLUTIONS OF NICKEL WITH ELEMENTS OF THE SECOND LONG PERIOD [LEITFAEHIGKEIT UND HALLKONSTANTE. 33: DIE MISCHKRISTALLE DES NICKELS MIT DEN ELEMEN DER ZWEITEN GROSSEN PERIODE DES PERIODENSYSTEMS]
W. Koester et al 1971 19 p refs Transl. into ENGLISH from Z. Metallk. (Stuttgart), v. 55, no. 12, 1964 p 805-810
(NRC-TT-1477) Avail: NTIS

The behavior of the specific electrical resistance, the ordinary and extraordinary Hall constants, as well as the absolute thermopower of disordered series of solid solutions of nickel with the elements of the first long period are discussed. Alloys of nickel with niobium, molybdenum, ruthenium, rhodium, and palladium were measured. Gold, which is the homologous element from the third long period, was used in place of silver, which is insoluble in nickel. Author

N71-35584# National Research Council of Canada, Ottawa (Ontario). Div. of Chemistry.
REMARKS ON THE BAND MODEL AND THE ELECTRONIC STRUCTURE OF METALS AND ALLOYS [BEMERKUNGEN ZUM BAENDERMODELL UND DER ELEKTRONENSTRUKTUR VON METALLEN UND LEGIERUNGEN]
Th. Ricker 1971 19 p refs Transl. into ENGLISH from Z. Metallk. (Stuttgart), v. 55, no. 12, 1964 p 784-789
(NRC-TT-1475) Avail: NTIS

A review is presented of the various ways of describing the electronic structure of metals and alloys based on the assumption of a rigid band model. Discussed are the manner and restrictions with which the band structure of different metals and alloys can be determined. The interpretation of the Hume-Rothery rule is considered as an example of an application of the work. Author

N71-35585*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CYCLIC FURNACE AND HIGH VELOCITY OXIDATION OF AN ALUMINIDE-COATED HIGH-STRENGTH NICKEL ALLOY (B-1900)
Stanley R. Levine Washington Sep. 1971 30 p refs
(NASA-TM-X-2370; E-6301) Avail: NTIS CSCL 11F

The oxidation resistance of aluminide-coated B-1900 was studied in furnace tests at 980 to 1150 C (1- to 20-hr cycles) and in burner rig tests at 1040 to 1150 C (1-hr cycles). Metallographic data from the 1-hour cyclic furnace tests indicated that a 40 C increase in temperature caused a tenfold reduction in coating life while a cycle frequency change from 1 to 20 hours per cycle increased life several fold. The leading edge of the burner rig specimens showed coating degradation about twenty times as severe as comparable furnace tests at 1090 C. Author

N71-35586# British Steel Corp., London (England). Metallurgy Dept.
METALLURGICAL DESIGN IN HIGHER YIELD STRENGTH STRUCTURAL STEELS
R. L. Craik, G. Tither (Centro Sper. Met., Sp. A., Roma), and A. B. Rothwell 1971 19 p refs
(PB-199293; MG/90/70) Avail: NTIS CSCL 11F

The development of steel properties by metallurgical control of alloying and processing conditions is discussed. The results of both laboratory and industrial-scale trails are detailed and it has been shown that yield strengths up to 46 kgf/sq mm, coupled with good impact properties, can be obtained in plates up to 50 mm thickness by controlled rolling low carbon, low alloy steels. The properties developed in these low alloy steels (approximately 0.10 W/oC) by quenching directly from the rolls, and subsequently tempering, are also given and show that yield strengths of 75 kgf/sq mm with sub-zero impact transition temperatures can be produced in 50 mm plate. The advantages and disadvantages of controlled processing methods are discussed in some detail. Author (GRA)

N71-35587# British Steel Corp., London (England). Strip Mills Div.
BIBLIOGRAPHY OF PUBLISHED LITERATURE ON ASPECTS OF PHYSICAL QUALITY OF HOT ROLLED STEEL STRIP, 1960 - 1970
D. Brinn 1971 21 p refs
(PB-199295; BISRA-SM/TN/1/5) Avail: NTIS CSCL 13H

A bibliography of reports on aspects of physical quality of hot rolled steel strip is presented. Subjects discussed are: (1) width gages for hot strip mills, (2) thickness gages, and (3) inspection equipment. The application of the instruments for improved quality control of finished product is described. Author (GRA)

N71-35588# TRW Systems Group, Redondo Beach, Calif.
GROSS STRAIN CRACK TOLERANCE OF A533-B STEEL
P. N. Randall 1 May 1971 56 p refs Prepared for Oak Ridge National Lab.
(Contract W-7405-eng-26)
(HSSTP-TR-14) Avail: NTIS

Gross strain crack tolerance is a measure of fracture toughness that is useful where yielding precedes fracture yet flaw size must be treated quantitatively. Rectangular bars containing surface fatigue cracks were pulled in tension at several temperatures. Strains were measured at the edges of the specimen on a gage length spanning the plane of the crack, and also in the gross section above and below the crack. Gross strain crack tolerance is the strain at maximum load on the gage length designated. It is a function of crack size, constraint and temperature, and perhaps other variables. In A533-B steel, the plots of all of the displacement measurements versus temperature showed a sharply defined transition temperature. The effects of crack size are reported in terms of the temperature at which the strain in the net section reached 1.5%, or the temperature at which gross section yielding occurred. Author (NSA)

N71-35589# Battelle Memorial Inst., Columbus, Ohio.
EVALUATION OF BERYLLIUM FOIL SUBJECTED TO BIAXIAL STRESSES Final Report
S. H. Gelles and A. Rudnick 10 Aug. 1970 60 p refs
(Contract W-7405-eng-92)
(BMI-X-604) Avail: NTIS

The uniaxial and biaxial tensile properties of five sources of beryllium foil nominally 0.004 in. thick were evaluated. Three of the materials were fabricated from ingot and two via the powder route. The materials displayed a grain size range between 10 and 45 microns and degrees of preferred orientation between essentially random to approximately eight times the random level. A plane-strain tensile test was successfully applied to the evaluation of the beryllium foil. Through this test and well-instrumented uniaxial tensile tests, both conducted in the rolling and transverse directions, it was possible to establish yield and fracture loci for combined tensile stresses. The asymmetry of the texture in the plane of the sheet and the degree of texture significantly affected both the uniaxial and biaxial mechanical properties of the foil. Grain size sensitively

affected the yield and fracture strength, whereas its effect on the ductility was small. The data generated in this program seem to support the hypothesis that there is an optimum nonrandom texture for maximum ductility in foil subjected to balanced biaxial stresses. Author (NSA)

N71-35590# Cornell Univ., Ithaca, N.Y. Dept. of Materials Science and Engineering.
ENVIRONMENT AND FRACTURE Progress Report
H. H. Johnson 20 Mar. 1971 6 p refs
(Contract AT(30-1)-3975)
(NYO-3975-3) Avail: NTIS

The results of studies of the effects of hydrogen and hydrogen-oxygen mixtures on the fracture of a high strength H11 steel in the precracked configuration at - 28 to + or - 100 C and various pressures are reported. Electrochemical permeation measurements on biaxially stressed iron and steel membranes exposed to a hydrogen-containing environment verified that the chemical potential of an interstitial solute depends only upon the hydrostatic component of an imposed stress state. This same apparatus is being used to study hydrogen brittleness. Exploratory studies of the effects of hydrogen on the mechanical properties of iron whiskers are reported. Author

N71-35591# Oak Ridge National Lab., Tenn.
EFFECT OF BORON ON THE DUCTILITY AND STRENGTH OF INCONEL 600 AND TYPES 304 AND 316 STAINLESS STEEL AT HOT METAL WORKING TEMPERATURES
A. K. Chakraborty, C. K. H. DuBose, and W. R. Martin May 1971 15 p refs
(Contract W-7405-eng-26)
(ORNL-TM-3316) Avail: NTIS

Inconel 600 and Types 304 and 316 stainless steel containing 0.0005 to 0.02% B were tensile tested at 900 to 1300 C. Boron had little effect on Inconel 600, but the stainless steels were weakened somewhat at higher temperatures for the higher boron contents. All alloys lost ductility at the highest temperatures for the higher boron concentrations. Author (NSA)

N71-35592*# General Electric Co., Cincinnati, Ohio.
HIGH-TEMPERATURE, LOW-CYCLE FATIGUE BEHAVIOR OF TANTALUM
R. LaForce, R. F. Berning, and L. F. Coffin, Jr. Washington NASA Sep. 1971 60 p refs
(Contract NAS3-10610)
(NASA-CR-1930; GESP-595) Avail: NTIS CSCL 11F

Elevated-temperature uniaxial, low-cycle fatigue tests are reported for unalloyed tantalum. Because of the extreme sensitivity of this metal to environmental contamination at high temperature, special techniques were developed to provide an inert argon atmosphere during the testing. The very high ductility of tantalum at the temperatures employed (up to 1350 F), coupled with its low strength, led to geometric instabilities in the high-strain, low-cycle regime and produced special testing problems. Results are compared to those of other structural metals and are presented in terms of equivalent stress-amplitude-fatigue design life for purposes of structural design. Tantalum was found to have high resistance to low-cycle fatigue, consistent with its high ductility. Author

N71-35593# Weiner Associates, Inc., Baltimore, Md.
THE DESIGN OF A TEST PROGRAM TO EVALUATE THE RE-ENTRY PROTECTION PERFORMANCE OF A METAL IMPREGNATED FOAMED ZIRCONIA THERMAL SWITCH MATERIAL FOR THE ZrH REFERENCE DESIGN REACTOR
Aug. 1970 23 p refs
(Contract AT(30-1)-4145)
(TID-25896; WAI-Tr-70.5/AEC) Avail: NTIS

Analyses were performed on ZrO2-silver foam material with 8 inches of LiH as a backup. It was found that the LiH front face reaches 950 F at impact, which is below the LiH melt temperature. The value of thermal conductivity used to account for switching is also shown. The LiH does not melt primarily due to the thermal soaking capability of the LiH biological shield. Since 4 to 5 inches of LiH is required to absorb sufficient heat to prevent surface melting, based on this analysis, the arc tunnel model would have to be 4 to 5 inches thick and approximately 5 inches in diameter (to get a reasonably uniform front face heating distribution). The maximum attainable heating rates for present NASA and Sandia facilities are 100 to 200 BTU/sq ft-sec/square root of R. The ZrH reference design reactor produces reference peak heating rates of 500 to 700 BTU/sq ft-sec/square root of R for earth orbital decay. At present, the ability to simulate pressure and shear forces in the arc tunnel is impossible. Author (NSA)

N71-35594# National Bureau of Standards, Washington, D.C.
PREPARATION AND EVALUATION OF SRM'S 481 AND 482 GOLD-SILVER AND GOLD-COPPER ALLOYS FOR MICROANALYSIS
Kurt F. J. Heinwrich, Robert L. Myklebust, Stanley D. Rasberry, and Robert E. Michelis Aug. 1971 101 p refs
(NBS-SP-260-28) Avail: SOD $1.00

The preparation and evaluation of standard reference materials for gold-silver and gold-copper alloys and proposed applications are discussed. The preparations of the materials, the chemical analysis, tests to determine microscopic and macroscopic homogeneity, and X-ray intensity measurements are described. A report of the instrumentation (matrix scanner), programs employed, and tables and graphs of X-ray intensity measurements is appended. Author

N71-35595# Naval Air Development Center, Johnsville, Pa. Aero Materials Dept.
ALUMINUM MATRIX CONTROLLED EUTECTICS Progress Report
Marshall K. Thomas and Ronald E. Trabocco 1 Mar. 1971 29 p refs
(AD-726424; NADC-MA-7105; PR-1) Avail: NTIS CSCL 11/6

Controlled eutectic Al-Si ingots were grown. Under the growth conditions of the investigation, it was necessary to raise the silicon content from 11.7 to 15.4 weight percent to eliminate aluminum dendrites. Fibrous, flake, and complex lamellar structures were observed in these ingots and appear to be a function of growth parameters and composition. Improvements in equipment and experimental technique will be necessary to provide more uniform growth speed, reduce oxidation, and insure homogeneity in composition. Author (GRA)

N71-35596# Naval Research Lab., Washington, D.C.
INVESTIGATIONS OF SELECTIVE INTERACTIONS OF THE IRON/AQUEOUS SODIUM CHLORIDE SYSTEM. PART 1: THE ADSORPTION OF CHLORIDE ION BY ALPHA-IRON (III) OXIDE IN SODIUM CHLORIDE SOLUTIONS SATURATED BY OXYGEN AT 30 C Interim Report
T. A. Kovacina and D. L. Venezky 28 May 1971 19 p refs
(ARPA Order 878)
(AD-726412; NRL-7264) Avail: NTIS CSCL 07/4

A radioisotope procedure was used to investigate the chloride ion adsorption characteristics of crystalline alpha-iron III oxide in dilute sodium chloride 36 C I-labeled solutions at 30 C. The adsorption of the chloride ion was found to be pH dependent, i.e., hydroxyl ions in solution also competed for the active sites on hydrated alpha-iron III oxide surfaces. The chloride ion was preferentially adsorbed in the solution pH range of approximately 2 to 4, while hydroxyl ion adsorption was favored in the pH range above 4 to approximately 9. Only a small fraction of the total surface area determined by the BET method was found active for chloride adsorption in an acid environment. Author (GRA)

N71-35597# Naval Research Lab., Washington, D.C.
FRACTURE EXTENSION RESISTANCE (R-CURVE) FEATURES OF NONFRANGIBLE ALUMINUM ALLOYS

Interim Report
R. J. Goode and R. W. Judy, Jr. 11 Jun. 1971 26 p refs
(AD-726411; NRL-7262) Avail: NTIS CSCL 11/6

New procedures were evolved to characterize the fracture extension resistance of nonfrangible structural aluminum alloys. Fracture extension resistance is a result of the increase in plastic work energy required to propagate a crack. The resistance parameter is defined as the R-curve slope of the metal. Characteristic R-curve features are presented for aluminum alloys ranging from frangible to high fracture toughness types. The R-curve slope determines the plastic work energy expended for fracture extension in structures, as confirmed by Explosion Tear Test results. The R curves are defined by using the Dynamic Tear test specimen in two configurations involving a short and standard fracture extension length. Indexing the R-curve slopes to the Ratio Analysis Diagram (RAD) for aluminum provides a definition of the capabilities of the metal for use in structures of low, intermediate, and high compliance features. This integration of structural aspects with the mechanical and metallurgical aspects of the RAD should significantly advance the generalized fracture-safe design of aluminum structures using nonfrangible alloys. Author (GRA)

N71-35699# Aerospace Corp., El Segundo, Calif. Lab. Operations.
THE EFFECT OF N2O4 AND UDMH ON SUBCRITICAL CRACK GROWTH IN VARIOUS HIGH-TOUGHNESS LOW STRENGTH STEELS
Louis Raymond and Raymond J. Usell 15 Jun. 1971 52 p refs
(Contract F04701-70-C-0059)
(AD-726540; TR-0059(6250-10)-8; SAMSO-TR-71-106) Avail: NTIS CSCL 11/6

The compatibility of four high-toughness steels (T-1, HY-140, HP-9-4-20, and 18 Ni (200) Maraging) with N2O4 and UDMH propellants was investigated. The compatibility was evaluated by general corrosion and stress corrosion tests at temperatures up to 120 F. Author (GRA)

N71-35698# Rutgers Univ., New Brunswick, N.J. Materials Research Lab.
FATIGUE STUDY OF QUENCHED AL-6.5 AT PERCENT Zn ALLOY Summary Report, 1 Jul. 1970 - 31 Jan. 1971
S. Weissmann and M. Kiritani May 1971 29 p refs
(Contract F33615-70-C-1240)
(AD-726582; AFML-TR-71-68) Avail: NTIS CSCL 11/6

The defect structure of an Al-6.5 at % Zn alloy induced by quenching and low-temperature aging (-80 to +60C) and the effects of fatigue cycling were investigated. The defect structure upon quenching consisted of homogeneously nucleated dislocation loops, helical dislocations developed from screw dislocations, the latter being introduced by two different processes. The defect structure also contained perfect loops converted from helical dislocations and faulted dislocation loops whose nucleation was enhanced by vacancies generated by quench deformation. Based on experimental evidence, a model is presented explaining the formation of a row of perfect dislocation loops from a single helical dislocation. The interrelation of the various types of induced defects is shown by correlating their formation with the aid of vacancy mechanisms. The absence of a delineated cell structure in the fatigue-cycled specimens and the homogeneous distribution of the dislocations within the grain were attributed to the barrier effect of the quench-induced dislocation loops pinned by precipitates. This barrier effect also gave rise to a large accumulation of dislocations at grain boundaries induced by cycling. The accumulation of dislocations at the grain boundaries appeared to provide the driving force for fatigue-induced boundary migration. The latter facilitated precipitation of zinc-rich particles at the boundaries. Author (GRA)

N71-35600# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
HIGH TEMPERATURE STEELS AND ALLOYS, PART 1
F. F. Khimushin 12 Apr. 1971 420 p Transl. into ENGLISH of the book "Zharoprochnye Stali i Splavy" USSR, 1969 p 1-749
(AD-726577; FTD-HC-23-391-70-Pt-1) Avail: NTIS CSCL 11/6

Contents: Classification of steels and alloys; Characteristics of the mechanical and physical properties of the alloys; Influence of deformation of the properties of high-temperature alloys; Influence of grain size on high-temperature strength of alloys; Influence of alloying on the diffusion parameters of metals and alloys; Influence of alloying elements on the high-temperature strength of austenitic steels; Scale-resistant steels and alloys; Properties of low-carbon chromium-nickel austenitic alloy steels; Carbide-hardened high-temperature steels; Properties of certain carbide-hardened high-temperature steels; Intermetallically hardened high-temperature steels; Foreign chromium-nickel and chromium-manganese high-temperature steels; Foreign high-temperature steels with intermetallic hardening; High-temperature foundry steels; Nickel-based high-temperature alloys. GRA

N71-35601# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
HIGH TEMPERATURE STEELS AND ALLOYS, PART 2
F. F. Khimiushin 12 Apr. 1971 458 p refs Transl. into ENGLISH of the book "Zharoprochnye Stali i Splavy" USSR, 1969 p 1-749
(AD-726578; FTD-HC-23-391-70-Pt-2) Avail: NTIS CSCL 11/6

The book discusses in detail the mechanical properties of high-temperature steels and alloys at room and high temperatures, the influence of alloying elements on structure and phase composition, heat-treatment and hot-forming methods, and the processes by which the alloys are produced. High-temperature alloys based on iron, nickel, and cobalt, as well as a number of refractory metals (W, Mo, Nb, Ta, Re, Cr) and their alloys are examined. Data are given on the stability of these alloys to high-temperature gas corrosion. Experience in the use of scale-resistant and high-temperature steels and alloys is summarized. Attention is also given to the most important foreign high-temperature steels and alloys. The properties of the alloys at cryogenic temperatures, their stability under nuclear bombardment, and their physical properties at various temperatures are described; supplementary material on the chemicothermal and heat treatment of the steels and alloys in vacuum and in protective atmospheres are provided. Author (GRA)

N71-35602# Cornell Aeronautical Lab., Inc., Buffalo, N.Y.
SOME CHARACTERISTICS OF AS GROWN ALUMINUM ALLOY SINGLE CRYSTALS Final Report
Richard C. Fabiniak May 1971 33 p refs
(Contract N00014-67-C-0418)
(AD-726714; CAL-KM-2432-P-8) Avail: NTIS CSCL 11/6

Single crystals of binary and ternary aluminum alloys with constituents having compositions within the commercial range, of high strength aluminum alloys were grown and their mechanical properties were characterized to provide a frame of reference for stress, corrosion and other studies of similar alloys. Each crystal was tested in tension and plots of resolved shear stress vs. shear strain were made from load vs. elongation curves. From these plots, the critical resolved shear stress was determined, some work hardening characteristics were established and the fracture stress was noted. Author (GRA)

N71-35603# Cornell Aeronautical Lab., Inc., Buffalo, N.Y.
A STRESS CORROSION CRACKING MODEL Final Report
Richard C. Fabiniak and Thaddeus J. Fabiniak May 1971 36 p refs
(Contract N00014-67-C-0418)
(AD-726713; CAL-KM-2432-P-7) Avail: NTIS CSCL 11/6

The characteristic susceptibility to stress-corrosion cracking exhibited by certain titanium and many aluminum alloys was studied. Mechanisms germane to establishing the conditions for stress-corrosion cracking in heat-treatable alloys during precipitation hardening are covered. A 7075 Al alloy and an

Al-Zn-Mg ternary alloy were used in construction of a stress-corrosion model. The model showed that the stress corrosion cracking susceptibility of Al alloys becomes reduced if one or more of the following can be realized: (1) elimination of the precipitation-free zone, PFZ, through proper heat treatment; (2) inducement of the formation of primary precipitates in the PFZ to enhance hardening; (3) inducement of the segregation of solute atoms to produce sufficient grain boundary hardening into the PFZ; (4) reduction of the PFZ width to a practical minimum; and (5) addition of an additive such as Cd, Sn and In to initiate precipitation of CuAl2 in the PFZ during initial aging. The resistance to stress-corrosion cracking will be increased because of: (1) the virtual elimination of the difference in mechanical properties between the PFZ and the train interior due to differences in thermal history, and (2) due to the presence of Cd, the reduction of the anodic effect at the grain boundaries.

Author (GRA)

N71-35604# Army Foreign Science and Technology Center, Charlottesville, Va.

THE NATURE OF HIGH-TEMPERATURE CREEP IN REFRACTORY-METALS AND ALLOYS [PRIRODA VYSOKOTEMPERATURNOI POLZUCHESTI TUGOPLAVKZKH METALLOV I SPLAVOV]

L. I. Ivanov et al 24 Jun. 1971 12 p refs Transl. into ENGLISH from the publ. "Struktura i Svoystva Zharoprochnykh Metallicheskikh Materialov" USSR, 1967

(AD-726840; FSTC-HT-23-433-70) Avail: NTIS CSCL 11/6

Based on an analysis of a theoretical creep equation for body-centered metals an equation is developed for practical use in calculating the steady-state creep rates of metals and alloys in accordance with their melting points. The validity of the equation obtained is confirmed by experimental investigations of steady-state creep rates for several Nb-Ti and Nb-W alloys at temperatures = 0.5 T sub mp. GRA

N71-35605# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

CORROSION OF CHEMICAL APPARATUS AND CORROSION RESISTANT MATERIALS

I. Ya. Klinov 22 Mar. 1971 183 p refs Transl. into ENGLISH from the monograph "Korroziya Khimicheskoi Apparatury i Korrozionnostoikie Materialy" Moscow, 1967 p 3, 5-13, 83-121, 205-238, 277-297, 317-351, 449-455

(AD-726803; FTD-HC-23-545-70) Avail: NTIS CSCL 11/6

The book deals with the principal theoretical problem in corrosion and the study of materials; it describes the properties of construction materials used for building apparatus and equipment. Author (GRA)

N71-35606 National Lending Library for Science and Technology, Boston Spa (England).

EFFECT OF HOLDING BETWEEN QUENCHING AND AGEING ON PRECIPITATION IN SOME ALUMINIUM ALLOYS

J. Moulin et al 12 Mar. 1971 29 p refs Transl. into ENGLISH from Mem. Sci. Rev. Met., v. 68, no. 12, Dec. 1969 p 881-893

(NLL-M-20408-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 3 NLL photocopy coupons

The effects of holding between quenching and artificial aging on the structure and mechanical properties of Al-Zn-Mg, Al-Mg-Si, and Al-Cu-Mg alloys were investigated. The evolution of the alloy structures and mechanical properties was examined as a function of natural aging. The effects of Ag additions, Mg-Si content, and excess Si on the Al alloys are included. J.M.

N71-35607 National Lending Library for Science and Technology, Boston Spa (England).

THE PITTING OF NICKEL

J. Tousek 16 Mar. 1971 15 p Transl. into ENGLISH from Collection Czech. Chem. Commun. (Prague), no. 34, 1969 p 929-937 In ENGLISH and GERMAN

(NLL-Trans-746-714-(9022.401); NLL-LTI-734-5581-(9022.401)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

The rate of pitting was studied using 99.999% pure nickel at a temperature of 22 + or - 1 C in potassium chloride solutions containing sodium sulfate and potassium hydroxide as inhibitors. The nickel electrode was initially activated at -1.1V and then subjected to passivation at a potential of -0.15 to 0.20 V. After 10 minutes the potential was raised to a value above the depassivation potential following which the rate of dissolution of the electrode was recorded as a function of time. The rate of pitting is expressed in terms of the current density measured 5 minutes after adjustment of the potential. The number of pits per sq cm of the surface was measured in sulfate-containing solutions after 2-15 minutes and in hydroxide solutions after 3 minutes. It was found that the dependence of pitting on time in the presence of sodium sulfate can be represented by a straight line and the behavior in alkaline solutions by a parabola having an exponential varying between 3 and 3.5. Author

N71-35608 National Lending Library for Science and Technology, Boston Spa (England).

CHANGE OF PROPERTIES DURING AGEING OF STAINLESS DISPERSION-HARDENED STEEL

V. M. Kondratov et al 17 Mar. 1971 11 p refs Transl. into ENGLISH from Fiz. Metal. Metalloved. (USSR), v. 29, no. 5, 1970 p 1051-1056 In ENGLISH and RUSSIAN

(NLL-LTI-746-680-(9022.401); LTI-737-9073) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The connection between the mechanical properties of 12Cr-7Ni-Al-Mo steel and the amplitude dependent internal friction was established. The maximum hardening corresponds to the minimum degree of internal friction, measured during stresses up to 26 kg/sq mm; this is caused by anchoring of the dislocations during ageing by segregation and, possibly by precipitates of highly dispersed intermetallics. An increase of the movement of dislocations during ageing at 520 C leads finally to the softening of the steel; this is accompanied by a decrease of the coercive force, micro stresses of the second type and, apparently, a considerable increase in the domain structure.

Author

N71-35609 National Lending Library for Science and Technology, Boston Spa (England).

THE BEHAVIOUR OF Nb STABILISED 2 1/4 Cr - 1 Mo STEEL (10 Cr - MoNiNb 910) UNDER NEUTRON IRRADIATION AT HIGH TEMPERATURE

H. Meyer et al 11 Mar. 1971 4 p Transl. into ENGLISH from German Atom Forum Reactor Meeting, 15-18 Apr. 1969 p 262-264

(NLL-Risley-Trans-2118-(9091.9F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

It is demonstrated that the steel 10 CrMoNiNb with 2 1/4% Cr, 1% Mo, small amounts of Ni, and additions of Nb to fix the carbon, is suitable as structural material in sodium cooled reactor plants. Microtensile and notched specimens were irradiated. Unirradiated specimens were also used. Comparisons show the irradiated specimens had a slight loss in strength, notch toughness remains unchanged in unirradiated specimens, in irradiated specimens the transition temperature shifted to lower temperatures. Metallographically, structural changes could be found resulting from irradiation. E.H.W.

N71-35610 National Lending Library for Science and Technology, Boston Spa (England).

ELECTRON-MICROSCOPIC STUDY OF PHASE TRANSFORMATIONS IN Ni-S SYSTEM

L. F. Kolesnichenko 17 Mar. 1971 13 p refs Transl. into ENGLISH from Poroshk. Met. (USSR), v. 10, no. 6, 1970 p 87-94 In RUSSIAN and ENGLISH

(NLL-LTI-746-742-(9022.401)) Avail: Natl. Lending Library,

Boston Spa, Engl.: 1 NLL photocopy coupon

A study of the structural phase state of a composite metal-nonmetal of nickel and sulfur is presented. An evaluation of the possibility of combining the processes of thermal-vacuum deposition of metallic and nonmetallic materials and for the production of composites used as antifriction materials is discussed. The section of the nickel-sulfur system is specified by the importance of sulfur as the basic component most widely used in antifriction compounds. Author

N71-35611 National Lending Library for Science and Technology, Boston Spa (England).
THE CASTING PROPERTIES OF SOME HIGH ALLOY STEELS
I. V. Gruznykh et al 17 Mar. 1971 10 p refs Transl. into ENGLISH from Tr. Leningrad. Politekh. Inst. (USSR), no. 295, 1968 p 117-121 in ENGLISH and RUSSIAN
(NLL-Trans-748-293-(9022.401); LTI-734-8774) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The steels investigated included: 18Cr-23Ni-W-Ti-A1, 15Cr-15Ni-3Mo-Nb, 18Cr-9Ni-Ti, 13Cr-10Mn-3Ni-Nb, 18Mn-3A 1-V, and 18Mn-Ni-V. Critical points were determined by thermal analysis and the results are given in tabular form. All steels tested gave well concentrated shrinkage holes and a comparatively small development of shrinkage friability. Values for the shrinkage coefficients were determined according to the kinetic curves for the free shrinkage of the samples. Results of crack resistance determinations are included. J.G.M.

N71-35612 National Lending Library for Science and Technology, Boston Spa (England).
ANALYSIS OF CONSTITUENTS IN NON-FERROUS METALLURGICAL MATERIALS BY ATOMIC ABSORPTION SPECTROPHOTOMETRY
D. J. Garcia 5 Apr. 1971 16 p refs Transl. into ENGLISH from Inform. Quim. Anal. (Madrid), v. 23, no. 6, 1969 p 169-184
(NLL-CE-Trans-5498-(9022.09)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

A method is presented for analyzing Zn, Pb, Cu, Cd, CaO, MgO, Al2O3, and insolubles, in minerals, slags, and mattes from smelting and evaporative furnaces and other products. The results are compared by atomic absorption with those obtained by other analytical techniques, finding that there is good agreement of values. A statistical study of the method is also carried out, showing good reproducibility of results. A description is given of the experimental conditions and the techniques used. Author

N71-35613 National Lending Library for Science and Technology, Boston Spa (England).
EFFECT OF ALLOYING ON DAMPING CAPACITY OF MAGNESIUM
M. E. Drits 17 Mar. 1971 8 p refs Transl. into ENGLISH from Izv. Akad. Nauk. SSSR, Metally (USSR), no. 2, 1970 p 206-209 in RUSSIAN and ENGLISH
(NLL-LTI-748-647-(9022.401); LTI-737-8417) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The changes of the damping characteristics of magnesium alloys, depending on the content of the alloting elements is discussed. Ten binary magnesium alloys were investigated to determine their suitability for use as construction materials. The systems were characterized by a difference in the physical-chemical interaction of the alloying elements with magnesium. The damping properties were measured on circular rod samples with diameter 6 millimeters and length 50 millimeters. Author

N71-35614 National Lending Library for Science and Technology, Boston Spa (England).
PHENOMENOLOGICAL ANALYSIS OF COMPACTION KINETICS OF METALLIC POWDERS DURING SINTERING. 5: CALCULATION OF COMPACTION ACCORDING TO KINETIC CONSTANTS OF POWDER
V. A. Ivanson 17 Mar. 1971 10 p Transl. into ENGLISH from Poroshkovaya Metall., v. 10, no. 6, 1970 p 24-28 in UKRANIAN
(NLL-LTI-748-743-(9022.401); LTI-737-9984) Avail: Natl. Lending Library, Boston Spa Engl.: 1 photocopy coupon

Metal powder compaction calculations for the entire sintering period including initial heating and isothermal soaking are presented. The calculations incorporate kinetic constants of the powder including the activation energy for imperfection removal, duration of activation energy, pre-exponential factors of the elementary processes, initial powder imperfection concentration kinetics, relative volume of pores, and correction factors. J.M.

N71-35615 National Lending Library for Science and Technology, Boston Spa (England).
EFFECT OF GRAIN SIZE ON CREEP OF PLATINUM RHODIUM ALLOYS
I. I. Novikov et al 17 Mar. 1971 8 p refs Transl. into ENGLISH from Izv. Vyssh. Uchab. Zaved., Tsvet. Metall. (USSR), v. 13, no. 3, 1970 p 110-113 in RUSSIAN and ENGLISH
(NLL-LTI-748-744-(9022.401); LTI-737-9628) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The effects of grain size on the creep properties of pure platinum are compared to those of platinum-rhodium alloys. Creep tests were conducted at 1300 C and initial stresses of .35, 1.0, and 1.3 kg/sq mm. Results show the creep rate of pure platinum increases with an enlargement of the grain and that of platinum-rhodium alloys decreases at first, then either hardly changes or slowly decreases. E.H.W.

N71-35616 National Lending Library for Science and Technology, Boston Spa (England).
INTERCRYSTALLINE FRACTURES IN A QUENCHED AND LOW TEMPERED STEEL
R. Sejnoha et al 17 Mar. 1971 7 p refs Transl. into ENGLISH from Sb. Ved. Pr. Vys. Sk. Baneke Ostrave (Czechoslovakia), v. 12, no. 5, 1966 p 463-467
(NLL-CE-Trans-5362-(9022.09)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The results obtained by examining fracture and carbide precipitation along the grain boundaries of a low alloy manganese silicon-chromium steel after hardening and tempering at 200 to 400 C, are given. The examination revealed that damage to austenite grain boundaries due to martensite transformation vanishes mostly before cementite starts to precipitate during tempering. Results also show the range of permanent tempering brittleness cannot be determined only by assessing etchability of the austenite grain boundaries since susceptibility of etching increases further in the range of tempering temperatures when the notch impact strength begins to rise. Author

N71-35617 National Lending Library for Science and Technology, Boston Spa (England).
ORGANIC ADDITIONS AND DETERMINATION OF PRODUCTS OF THEIR CONVERSION IN ELECTROLYTES DURING ELECTRODEPOSITION OF METALS. 3: DETERMINATION OF ACETANILIDE, BENZENESULPHONAMIDE AND BUTYNDIOL DURING THEIR COMBINED PRESENCE IN ELECTROLYTES FOR BRIGHT NICKEL PLATING
D. Mockute et al 17 Mar. 1971 8 p refs Transl. into ENGLISH from Lietuvos TSR Mokslu Akad. Darbai: Ser. B (Vilnius), v. 60, no. 1, 1970 p 159-162 in RUSSIAN and ENGLISH
(NLL-LTI-748-727-(9022.401); LTI-734-5834) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The quantitative determination of acetanilide and benzene-sulphonamide in electroplating solutions by spectrophotometry is discussed. The concentration of butyndiol is found by bromination only when acetanilide is removed from the

electroplating solution. The concentration of butyndiol being known, acetanilide may be determined by bromination. Benzenesulphonamide is extracted from the electroplating solution together with acetanilide and determined by gravimetric method if the concentration of the latter is already known.
Author

18 MATERIALS, NONMETALLIC

Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics.

N71-35618*# Washington Univ., Seattle. Ceramic Engineering Div.
INTERDISCIPLINARY RESEARCH CONCERNING THE NATURE AND PROPERTIES OF CERAMIC MATERIALS Semiannual Status Report, 16 Dec. 1970 - 15 Jun. 1971
James I. Mueller 30 Jun. 1971 38 p
(Grant NGL-48-002-004)
(NASA-CR-121890; SASR-16) Avail: NTIS CSCL 11B

Operations of the Ceramics Materials Research Program at the University of Washington are discussed. Projects discussed include (1) refractory surface insulation; (2) chemical environment; (3) mechanical properties; (4) surface phenomena; (5) atomic and molecular effects; and (6) processing and fabrication of ceramics.
A.L.

N71-35619*# Engelhard Minerals and Chemicals Corp., Newark, N.J. Engelhard Industries Div.
DEVELOPMENT OF A PLATINUM-THORIUM OXIDE ALLOY FOR RESISTOJET THRUSTER USE Final Report
H. J. Albert and J. S. Hill Jul. 1971 34 p
(Contract NAS1-10433)
(NASA-CR-111959) Avail: NTIS CSCL 11D

Stress-rupture testing showed a considerable increase in stress-rupture life for platinumthoria alloys over the commercial platinum-rhodium alloys. Adding thoria to platinum at the 0.6% level has relatively little effect on the room temperature mechanical and electrical properties. The principal effect of the thoria is to provide a stable, elongated grain structure, thereby improving the long term, load carrying capacity at elevated temperatures. Tubing was fabricated without difficulty from the platinum 0.6% thoria alloys. Joining tests were carried out by electron-beam welding, dap welding, diffusion bonding, spot welding and high temperature brazing.
Author

N71-35620*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
OPTICAL TRANSMITTANCE OF FUSED SILICA AT ELEVATED TEMPERATURES DURING HIGH ENERGY ELECTRON BOMBARDMENT
Albert B. Smith 1971 11 p refs Proposed for presentation at Uranium Plasma Conf., Atlanta, 15-17 Nov. 1971; Sponsored by AIAA
(NASA-TM-X-67930; E-6595) Avail: NTIS CSCL 11D

An experimental determination of the optical transmission of Corning 7940 UV and Suprasil I fused silica was made. The LeRC dynamitron provided the equivalent ionizing radiation and high temperature that the transparent gas divider of an operating nuclear light bulb engine would experience. The irradiation induced absorption was measured at 2150 A, 2700 A, and 4500 A. The length of the irradiations were sufficient so that an equilibrium between radiation induced coloration and high temperature annealing was reached. The experimental results indicate a significant optical absorption particularly at the shorter wavelength, which would make the use of fused silica in this concept questionable.
Author

N71-35621# Joint Publications Research Service, Washington, D.C.
MATERIAL FOR MHD GENERATOR CHANNEL
A. I. Rekov, ed. 31 Aug. 1971 229 p refs Transl. into ENGLISH from the book "Materialy Dlya Kanala MGD Generatora" Moscow, Nauka, 1969 p 9-225
(JPRS-53939) Avail: NTIS

The development of refractory materials for use in magnetohydrodynamic generator channels is discussed. Materials tests to determine the physical and mechanical properties of the refractory materials are described. The specific application of the refractory materials for insulation and electrodes is presented. For individual titles, see N71-35622 through N71-35646.

N71-35622# Joint Publications Research Service, Washington, D.C.
RESULTS OF TESTS AND ANALYSES OF HIGH REFRACTORY MATERIALS FOR MHD GENERATOR CHANNEL
A. I. Rekov *In its* Mater. for MHD Generator Channel 31 Aug. 1971 p 4-19 refs (See N71-35621 22-18)
Avail: NTIS

The requirements on materials for an open cycle MHD generator channel and results of analysis of compositions suitable for this purpose are discussed. The results of research on thermal stability, evaporability and electrophysical properties of refractory structural materials are presented. Aging and interaction with other oxides are discussed for zirconium dioxide systems. Efforts to synthesize and analyze the properties of silicon carbide and its compositions with high-melting metals (molybdenum, titanium, etc.) are described. The results of analysis of materials under full-scale conditions of open cycle MHD generator channel operation, showing the promise of oxide systems based on zirconium dioxide and silicon carbide with additives as electrode materials, are included.
Author

N71-35623# Joint Publications Research Service, Washington, D.C.
ELECTRODE MATERIALS BASED ON SILICON CARBIDE FOR OPEN CYCLE MHD GENERATORS
G. M. Kafarova et al *In its* Mater. for MHD Generator Channel 31 Aug. 1971 p 20-28 refs (See N71-35621 22-18)
Avail: NTIS

The results of chemical, X-ray diffraction, electron microscopic and other analyses of ceramics based on silicon carbide after about 50 hours of operation in the channel of the U-02 installation are presented. The general laws of change of structure and properties of the material are established. Silicon carbide, alloyed with high-melting metals (Ti, Mo, Cr,) is used as the electrode material for long-term operation in the MHD generator channel up to an electrode surface temperature equal to 1,800 K.
Author

N71-35624# Joint Publications Research Service, Washington, D.C.
RATE OF EVAPORATION AND EROSION OF SILICON CARBIDE CERAMICS
R. I. Abraytis et al *In its* Mater. for MHD Generator Channel 31 Aug. 1971 p 29-32 refs (See N71-35621 22-18)
Avail: NTIS

The rate of evaporation of ceramics based on silicon carbide, alloyed with high-melting metals, to a temperature of 2,000 K is investigated. The erosion stability of the stated ceramics at 2,000 K is also analyzed. It is established that vigorous evaporation of the ceramics in air begins at 1,950 K and that the material can operate up to that temperature.
Author

N71-35625# Joint Publications Research Service, Washington, D.C.
ELECTRICAL RESISTIVITY OF POLYCRYSTALLINE COMPOSITIONS BASED ON SILICON CARBIDE

B. M. Berykin et al *In its* Mater. for MHD Generator Channel 31 Aug. 1971 p 33-38 refs (See N71-35621 22-18)
Avail: NTIS

The temperature dependence of electrical resistivity of complex compositions of silicon, carbon, and metals at high temperatures (up to 2,000 K) is investigated. It is established that the electrical resistivity of the compositions is essentially the result of the presence of free silicon. Author

N71-35626# Joint Publications Research Service, Washington, D.C.
HIGH TEMPERATURE BEHAVIOR OF CONSTRUCTION MATERIAL WITH HIGH SILICON CARBIDE CONCENTRATION IN DIFFERENT GAS MEDIA
V. I. Yelchin *In its* Mater. for MHD Generator Channel 31 Aug. 1971 p 39-47 refs (See N71-35621 22-18)
Avail: NTIS

The results of thermogravimetric analysis of the effect of various media (argon, nitrogen, air, water vapor and vacuum) at temperatures up to 2,000 K on silicon carbide construction material are presented. The kinetic curves of the weight change of the specimens as a function of the medium and temperature are constructed. Changes in structure on the surface and within the specimens, which take place during calcination are analyzed electron microscopically. A conclusion is made concerning the possible long-term application of the analyzed material under different conditions. Author

N71-35627# Joint Publications Research Service, Washington, D.C.
OXIDE MATERIALS FOR HOT CHANNEL OF OPEN CYCLE MHD GENERATOR
A. B. Ivanov et al *In its* Mater. for MHD Generator Channel 31 Aug. 1971 p 48-58 refs (See N71-35621 22-18)
Avail: NTIS

Information about the properties of oxide electrode materials and the results of testing in experimental channel of open cycle MHD generator is presented. As a result of combined studies on the problem of materials for MHD power plants, the requirements on materials for individual components of MHD generators, the scope of promising materials and the principles for their use in fabrications have been determined. Author

N71-35628# Joint Publications Research Service, Washington, D.C.
EROSION RESISTANCE OF YTTRIUM OXIDE STABILIZED ZIRCONIUM DIOXIDE
R. I. Abraytis et al *In its* Mater. for MHD Generator Channel 31 Aug. 1971 p 59-63 refs (See N71-35621 22-18)
Avail: NTIS

The results of analysis of erosion stability of zirconium dioxide stabilized with yttrium oxide under conditions corresponding to the operation of electrodes in an open cycle MHD generator channel are described. It is shown experimentally that at an electrode surface temperature of 2,300 K and flow velocity of 500 m/sec of ionized combustion products the investigated materials possess high resistance to the erosive action of the gas flow (rate of mass erosion 0.02 grams per square meter times seconds. Author

N71-35629# Joint Publications Research Service, Washington, D.C.
ELECTRON MICROSCOPIC AND X-RAY DIFFRACTION ANALYSES OF YTTRIUM OXIDE STABILIZED ZIRCONIUM DIOXIDE
A. Ye. Rautbort et al *In its* Mater. for MHD Generator Channel 31 Aug. 1971 p 64-75 refs (See N71-35621 22-18)
Avail: NTIS

The structure of chemically pure and technical zirconium dioxide, stabilized with yttrium oxide is analyzed by the electron microscopic and X-ray diffraction methods. Changes in its fine and porous structure during long-term high-temperature heating in test stands and during operation in an MHD generator channel are described. Author

N71-35630# Joint Publications Research Service, Washington, D.C.
DEVELOPMENT OF PRODUCTION TECHNOLOGY AND EXPERIMENTAL ANALYSIS OF PERICLASE INSULATORS OF MHD GENERATOR CHANNEL
D. N. Poluboyarinov et al *In its* Mater. for MHD Generator Channel 31 Aug. 1971 p 76-81 refs (See N71-35621 22-18)
Avail: NTIS

Magnesium oxide insulators were tested in the cathodic and anodic walls of an experimental open cycle MHD generator channel. It was established as a result of the tests, and also of experimental analysis of the properties of sintered magnesium oxide of granular structure, that this material can operate reliably in an MHD generator channel at 2,100 K. Author

N71-35631# Joint Publications Research Service, Washington, D.C.
BASIC RESULTS OF THE USE OF ZIRCONIUM DIOXIDE REFRACTORIES IN HIGH TEMPERATURE COMBUSTION CHAMBER OF EXPERIMENTAL POWER PLANT WITH OPEN CYCLE MHD GENERATOR
A. I. Rekov et al *In its* Mater. for MHD Generator Channel 31 Aug. 1971 p 82-95 refs (See N71-35621 22-18)
Avail: NTIS

Tests of refractories based on zirconium dioxide in a high-temperature combustion chamber of a power plant with an MHD generator are discussed. The parameters of the operating modes of the high-temperature combustion chamber and the conditions under which the zirconium dioxide refractories operated are described. The production technology of ZrO_2 refractories, partially stabilized with Y_2O_3, is also described. The use of zirconium dioxide refractories in the walls of high-temperature combustion chambers is mentioned in consideration of their high thermal and erosion stability and their relative inertness in relation to alkali additives in the high-velocity flow of combustion products. Author

N71-35632# Joint Publications Research Service, Washington, D.C.
INVESTIGATION OF REFRACTORY CONCRETES FOR INSULATING WALLS OF MHD GENERATOR CHANNEL
B. M. Berykin et al *In its* Mater. for MHD Generator Channel 31 Aug. 1971 p 96-109 refs (See N71-35621 22-18)
Avail: NTIS

The results of studies on the development of technology and properties of high-refractory magnesial and high-aluminous concretes that satisfy the requirements imposed on the electrical insulation materials for MHD generator channels are presented. Analyses of the physico-mechanical properties of a series of concrete compositions as functions of the hardening time, amount and granulometric composition of the filler, heat treatment temperature, water bonding ratio and other factors are analyzed. The phase composition and structure of concretes are analyzed with the aid of fine physico-chemical methods. The compositions are evaluated from the viewpoint of their heat and erosion resistance on the basis of the results of testing on a laboratory gas dynamics test stand. Author

N71-35633# Joint Publications Research Service, Washington, D.C.
ELECTRICAL CONDUCTIVITY OF REFRACTORY CONCRETES AND REINFORCED MATERIALS BASED ON MINERAL BONDING AGENTS
T. I. Shakhtakhtinskiy et al *In its* Mater. for MHD Generator Channel 31 Aug. 1971 p 110-115 refs (See N71-35621 22-18)
Avail: NTIS

The results of analysis of the resistivity of refractory

concretes and reinforced materials based on high-aluminous and barium-aluminous cements and aluminum phosphate bonding agent as a function of temperature (20-1,400 C)are discussed. The contact galvanometric method of measuring electrical resistivity, the composition and production technology of the specimens are briefly described. The findings are subjected to comparative analysis. Author

N71-35634# Joint Publications Research Service, Washington, D.C.
INVESTIGATION OF SPECTRAL EMISSIVITY OF OXIDES AND CONCRETES IN VISIBLE REGION OF SPECTRUM
A. S. Abramov et al *In its* Mater. for MHD Generator Channel 31 Aug. 1971 p 116-125 refs (See N71-35621 22-18)
Avail: NTIS

The procedure for determining the emissivity of diffusely reflective materials in the visible region of the spectrum (lambda = 0.436 and 0.546 micron) is discussed. The results of analysis of the emissivity of several refractory oxides (aluminum oxide, magnesium oxide, zirconium dioxide) and of refractory concretes based on various bonding agents and fillers at high temperatures (1,100-2,100 K) are reported. Author

N71-35635# Joint Publications Research Service, Washington, D.C.
STUDY OF EMISSIVITY OF OXIDES AND CONCRETES IN INFRARED REGION OF SPECTRUM
A. S. Abramov et al *In its* Mater. for MHD Generator Channel 31 Aug. 1971 p 126-131 refs (See N71-35621 22-18)
Avail: NTIS

The emissivity of refractory oxides and concretes in the infrared region of the spectrum (wavelength 5 micron) at high temperatures (1,500-2,000 K) is investigated. The investigation procedure, based on the simultaneous and independent determination of true temperature by the reflection method and of brightness temperature in the infrared region by comparison with a black body, is described. Author

N71-35636# Joint Publications Research Service, Washington, D.C.
EXPERIMENTAL STUDIES OF STRENGTH OF REFRACTORY CONCRETES AT HIGH TEMPERATURES
L. I. Fedotova et al *In its* Mater. for MHD Generator Channel 31 Aug. 1971 p 132-136 refs (See N71-35621 22-18)
Avail: NTIS

The production technology of high-refractory concretes is described. The results of determination of strength of magnesial and high-aluminous concretes at room temperature and at working temperatures are presented. The structure is analysed in the initial condition and after aging under stress at high temperatures. Author

N71-35637# Joint Publications Research Service, Washington, D.C.
THERMAL EXPANSION COEFFICIENT OF HIGH ALUMINOUS AND MAGNESIAL CONCRETES
R. Ya. Drozdov et al *In its* Mater. for MHD Generator Channel 31 Aug. 1971 p 137-140 refs (See N71-35621 22-18)
Avail: NTIS

The results of an experimental investigation of the thermal expansion coefficient of high-aluminous and magnesial concretes in the following temperature ranges: 20-1,600 C for HAC; 20-1,800 C for MC are presented. A knowledge of the thermal expansion coefficient is very important in the use of refractory materials in individual assemblies of MHD power plants operating at high temperature. Data concerning the thermal expansion coefficient are essential for arriving at the optimal design of individual components and for analyzing structural changes that occur within a material during the process of high-temperature operation. Author

N71-35638# Joint Publications Research Service, Washington, D.C.
INVESTIGATION OF REFRACTORY MATERIALS FOR CHANNEL OF OPEN CYCLE MHD POWER PLANTS
V. R. Akopov et al *In its* Mater. for MHD Generator Channel 31 Aug. 1971 p 141-154 refs (See N71-35621 22-18)
Avail: NTIS

The problem of maintaining on the working surfaces of the channel walls of MHD generators, the temperature that ensures the preservation of the insulating or conducting properties of materials, as well as their resistance to erosive wear, is discussed. The results of tests of electrical insulation (high-aluminous and magnesial concretes) and electrode (siliconized graphite, borosilicocarbides, SiC, modified with additives Mo and Ti) materials in the gas flow are analyzed. It is interpreted that the essential condition of the use of existing refractory materials in open cycle MHD channels is their cooling. The gas flow parameters that determine the critical heat flow, leading to destruction of the tested specimens, are determined. Thin-layer films of refractory materials with good thermal contact with the cooled substrate are recommended as promising materials. Author

N71-35639# Joint Publications Research Service, Washington, D.C.
TEST RESULTS OF CONSTRUCTION MATERIALS IN MODEL MHD POWER PLANT CHANNEL
Yu. V. Baryshev et al *In its* Mater. for MHD Generator Channel 31 Aug. 1971 p 155-165 ref (See N71-35621 22-18)
Avail: NTIS

Insulation walls of a model channel made of high-aluminous concrete (HAC) in a flow of low-temperature air plasma, the source of which was a direct current plasmatron, are discussed. It is established that HAC refractory concrete operates without failure in model MHD channels at a wall temperature up to 1,700 C and test time up to 15 min. During the experiment the resistance of the insulation walls (with and without additives during the tests) and change in temperature through wall thickness were measured in the channel. It was established that the insulation walls of the channel become saturated with compounds of iron and potassium, which have an effect on the electrical resistivity of the wall. An equation is given for determination of the electrical resistivity of the insulation wall and a method of calculating the temperature profile through wall thickness is described. Author

N71-35640# Joint Publications Research Service, Washington, D.C.
TESTING OF OPEN CYCLE MHD GENERATOR CHANNEL ELEMENTS IN TEMP PLANT c25
V. V. Kirillov et al *In its* Mater. for MHD Generator Channel 31 Aug. 1971 p 166-176 (See N71-35621 22-18)
Avail: NTIS

The design and working parameters of the experimental installation for MHD research are described. The results of tests of various design variants of electrical insulation components of the MHD generator channel based on high-aluminous and magnesial concretes, and of electrodes, made of stainless steel, SiC and Y2O3-stabilized ZrO2 are discussed. The significance of the results obtained, which permit the optimal design of insulation panels and electrodes which meet the requirements imposed on the components of MHD generator channels, is established. Author

N71-35641# Joint Publications Research Service, Washington, D.C.
CERTAIN PROPERTIES OF REFRACTORY CERMETS
V. A. Nikolayeva et al *In its* Mater. for MHD Generator channel 31 Aug. 1971 p 177-182 refs (See N71-35621 22-18)
Avail: NTIS

Certain properties of cermet materials based on refractory carbides with additives of the metal rhenium are described. Noted, in particular, is the considerable increase in the emission

current density of niobium carbide cermet. A number of refractory compounds with interstitial phases, among which are carbides, silicides, borides, and others, can be used in experimental MHD power plants. The carbides of refractory metals, in particular the carbides of zirconium and niobium, can be used for the open cycle of MHD generators as electrodes. They are characterized by such properties as high melting point, high conductivity, comparable to metals, sufficient strength at high temperatures, greater resistance to oxidation compared to pure metals, high emissivity, weldability with metals and other properties. Author

N71-35642# Joint Publications Research Service, Washington, D.C.
INVESTIGATION OF REDUCTION OF NIOBIUM PENTOXIDE BY LAMPBLACK c06
V. A. Nikolayeva *In its* Mater. for MHD Generator Channel 31 Aug. 1971 p 183-190 refs (See N71-35621 22-18)
Avail: NTIS

The reduction of niobium pentoxide with lampblack in the range of temperatures from the beginning of reduction to 1,800 C in a vacuum of 0.01 to 0.001 to .010 mm Hg is examined. It is found that the processes of diffusion of carbon into the niobium lattice is retarded by the presence of small quantities of oxygen. It is demonstrated experimentally that under conditions of pressure of 0.01-0.001 mm Hg with the temperature rising at the rate of 10 deg/min to 1,700-1,800 C and maintenance of this temperature for 4 hours, a product with maximum concentration of bonded carbon (up to 11.45%) is obtained. Author

N71-35643# Joint Publications Research Service, Washington, D.C.
ELECTRON BEAM WELDING OF ZIRCONIUM CARBIDE AND NIOBIUM CARBIDE ELECTRODES TO STAINLESS STEEL c15
N. A. Olshanskiy et al *In its* Mater. for MHD Generator Channel 31 Aug. 1971 p 191-198 refs (See N71-35621 22-18)
Avail: NTIS

A method of electron beam welding of the carbides of zirconium and niobium to stainless steel is developed. Metallographic analysis of the weld seam is described and the mechanism of the formation of the weld is disclosed. The welding of carbides to stainless steel 1Kh18P9T has practically no effect on the conductivity of the construction. Author

N71-35644# Joint Publications Research Service, Washington, D.C.
PRODUCTION OF BORON SILICIDES AND ANALYSIS OF THEIR ELECTRICAL CONDUCTIVITY c15
L. B. Lutnova et al *In its* Mater. for MHD Generator Channel 31 Aug. 1971 p 199-203 refs (See N71-35621 22-18)
Avail: NTIS

The electrical conductivity properties of boron and silicon compounds produced by hot pressing and sintering of cold-pressed pellets are presented. It is shown that the electrical conductivity of specimens corresponding in composition to stoichiometric compounds of boron and silicon has a very distinct curve of the temperature dependence of electrical resistivity. Author

N71-35645# Joint Publications Research Service, Washington, D.C.
THERMIONIC EMISSION OF CERTAIN REFRACTORY MATERIALS
S. S. Kulvarskaya et al *In its* Mater. for MHD Generator Channel 31 Aug. 1971 p 204-218 refs (See N71-35621 22-18)
Avail: NTIS

The thermal emission of many refractory materials is measured in vacuum, argon, and cesium vapors. It is shown that argon does not substantially alter thermal emission; the thermal emission of inefficient emitters increases sharply in cesium vapors, whereas cesium has little effect on the thermal emission of efficient emitters (LaB6, ThO2). Recommendations are made concerning the use of the investigated materials as thermocathodes in a complex gaseous medium. Author

N71-35646# Joint Publications Research Service, Washington, D.C.
EMISSIVITY OF PYROGRAPHITE
S. M. Barykin et al *In its* Mater. for MHD Generator Channel 31 Aug. 1971 p 219-224 refs (See N71-35621 22-18)
Avail: NTIS

The monochromatic emissivity, on a wavelength of 0.65 micron, of pyrographite produced at various temperatures by precipitation for the purpose of studying the effect of this parameter on the emission properties of pyrographite, is discussed. The monochromatic emissivity of pyrographite on and perpendicular to the base plane is determined for the purpose of studying anisotropy of emission properties. Author

N71-35647# Bureau of Mines, Washington, D.C.
THE RARE-EARTH ELEMENTS, YTTRIUM, AND THORIUM: A MATERIALS SURVEY
John G. Parker and Charles T. Baroch 1971 99 p refs
(BM-IC-8476) Avail: SOD $1.00

The yttrium and thorium demand-supply position in the United States is summarized. Information on yttrium and thorium properties, resources, industry structure, production, consumption, trade, strategic factors, technology, and pertinent history is included. J.M.

N71-35648# British Steel Corp., London (England). Chemistry Dept.
INFLUENCE OF IRON AND CHROMIUM ON CRYSTALLIZATION OF SOME CaO-Al2O3-MgO-SiO2 GLASSES
M. J. Robson and M. W. Davies 1971 7 p refs Presented at the Conf. on the Silicate Ind., Budapest, 15-20 Jun. 1970
(PB-199292; BISRA-C/64/69) Avail: NTIS CSCL 11B

Devitrification kinetics were investigated in some CaO-Al2O3-MgO-SiO2 glasses of approximately metasilicate composition containing iron and chromium. In the range studied (2.0 - 7.0 wt FeO and 0.5 - 0.9 wt Cr2O3) the nucleation rate on heat treatment increases rapidly with increase in chromium and with increase in iron content. The rate of crystal growth increases very rapidly with iron content and decreases with increase in chromium content. The apparent activation energies for nucleation and crystal growth are fairly similar and show no clear relationship with composition. The values are larger than those which would be expected for diffusion of cations and are closer to activation energies for viscous flow. Although electron microscopy has not revealed any other phase separating before the appearance of silicate crystals, the kinetic behaviour agrees with a model for heterogeneous nucleation of silicate upon pre-existing particles. Author (GRA)

N71-35649# Universal Water Corp., Del Mar, Calif.
CHARACTERIZATION OF CELLULOSE ACETATE BUTYRATE MEMBRANES Progress Report
S. Manjikian, M. I. Foley, Chung-Ming Wong, W. Sherman Gillam, and H. E. Podall Dec. 1970 117 p refs
(Contract DI-14-30-2517)
(PB-196956; OSW-PR-612) Avail: NTIS CSCL 11I

The characterization of cellulose acetate butyrate membranes, the optimization of cellulose acetate butyrate membranes, the optimization of butyrate membrane performance, and the production of tubular butyrate membranes are investigated. In addition, work was initiated on CA-CAB bi-membranes and noncellulosic polymers as membrane materials. Exploratory formulations were prepared and tested to evaluate the effect of certain variations in casting solution compositions on membrane performance. Additives to the standard formulation such as glyoxal, have resulted in 50 to 100 percent improvement in

membrane flux with an acceptable reduction in membrane selectivity. In addition, membranes of a wide range of properties were prepared from identical casting mixtures by varying fabrication conditions, specifically with diethanolamine as an additive. Author (GRA)

N71-35650# Union Carbide Corp., Oak Ridge, Tenn. Y-12 Plant.
MECHANICAL BEHAVIOR OF A UNIAXIALLY ALIGNED TUNGSTEN WIRE-REINFORCED LEAD COMPOSITE SYSTEM
E. L. Courtright, Jr. 9 Apr. 1971 105 p refs
(Contract W-7405-eng-26)
(Y-1788) Avail: NTIS

A study of the mechanical behavior of tungsten reinforced-lead matrix composites tested in uniaxial tension at room temperature revealed that variations in the strain hardening exponent of the matrix were at least partially responsible for synergistic departures from rule-of-mixtures behavior. The degree of synergism appeared to increase with the volume fraction of fiber as well as with the magnitude of the strain hardening exponent. Efforts were made to separate the axial stress contribution due solely to the matrix from which it was observed that the stress-strain behavior of the unreinforced matrix tested by itself would not adequately represent matrix behavior in the composite. An analytical model was used to calculate the axial and transverse stress distribution in the matrix as a function of axial strain in the composite. The model was used to predict an increase in each of the three stress components with increasing volume fraction of fiber; and, as a result, it provides a more useful tool for predicting composite behavior than does the more conventional rule-of-mixtures formula. Author (NSA)

N71-35651# Hanford Engineering Development Lab., Richland, Wash.
RESISTIVITY MEASUREMENTS OF INSULATORS USING THE FOUR-PROBE TECHNIQUE
R. R. Schemmel and R. L. Gordon 21 Apr. 1971 23 p refs
Presented at the 73rd Ann. Meeting of the Am. Ceramics Soc., Chicago, 26 Apr. 1971
(Contract AT(45-1)-2170)
(HEDL-SA-119; Conf-710415-1) Avail: NTIS

Difficulties encountered in attempts to employ four-probe insulation measurement techniques are discussed. Constant application of voltage or current causes polarization of ionic conductors. Experiments indicate charge density collection at interfaces sufficient to vary potential distributions across a sample with time, thus causing non-linearities between sample current and probe voltage. At elevated temperatures, thermally emitted electrons increase the electron density and/or ion concentration surrounding a sample, causing net currents in the gas phase and erroneous sample current measurements. Actual measured emission currents approximated apparent sample currents at these temperatures, and conductivity curves indicated that parallel paths through the atmosphere shunt sample currents. The monitored potential distribution across the sample surrounded by an equipotential shield indicated direct coupling between the shield and sample at elevated temperatures. Above 1100 C measured potentials approach shield voltages.
Author (NSA)

N71-35652*# Hughes Aircraft Co., Culver City, Calif. Aerospace Group.
PREPARATION AND CHARACTERIZATION OF THE PYRRONES AS THERMAL STRUCTURAL MATERIALS
B. G. Kimmel and L. E. Karre Washington NASA Sep. 1971 96 p refs
(Contract NAS1-7381)
(NASA-CR-1791) Avail: NTIS CSCL 11D

The development of techniques for preparing foams of various densities from Pyrrone polymers is discussed. The Pyrrone polymers are formed by the condensation reaction of aromatic dianhydrides with aromatic tetraamines. Foams with densities between 20 and 60 pounds per cubic foot have been produced. The application of the foams for thermal structural materials is examined. Author

N71-35653# Walter Reed Army Medical Center, Washington, D.C. Medical Biomechanical Research Lab.
EVALUATION OF POLYURETHANE AS A COSMETIC GLOVE MATERIAL
John W. Hodge, Jr., William P. Bartels, and John J. Urban May 1971 14 p ref
(AD-726374; TR-7101) Avail: NTIS CSCL 06/12

Polyurethane latex was evaluated for possible use as a cosmetic glove material. A two component latex system was used with a number of films and a cosmetic glove being fabricated and evaluated with varying amounts of the two components. The mechanical properties indicate that the material is sufficiently strong. However, there were other problems encountered in low temperature flexure and staining.
Author (GRA)

N71-35654# Naval Air Development Center, Johnsville, Pa.
SOLUTION OF TWO-BODY AXIALLY-SYMMETRIC ELASTICITY PROBLEMS BY THE DISTRIBUTION OF SINGULARITIES
Richard E. Llorens and Edward J. McQuillen 7 Jul. 1971 30 p refs
(AD-726425; NADC-AM-7116) Avail: NTIS CSCL 20/11

A general method is presented for determining the displacement and stress fields within axially-symmetric elastic bodies due to prescribed internal loadings and boundary conditions. The solutions obtained satisfy the exact three-dimensional equations of linear elasticity. Determination of the proper distribution of singularities is the essence of this method. The formulation is applicable to multi-body problems, as illustrated by a two-body example presented, and may serve to generate information on interface stresses in fiber reinforced composite materials. Author (GRA)

N71-35655# Naval Air Development Center, Johnsville, Pa. Aero Materials Dept.
BERYLLIUM WIRE-METAL MATRIX COMPOSITES
Progress Report, 1 Jul. 1969 - 30 Oct. 1970
Ronald E. Trabocco 19 Feb. 1971 30 p refs
(AD-726423; NADC-MA-7104) Avail: NTIS CSCL 11/4

The report describes the work completed and in process on roll bonding beryllium wire - metal matrix composites. It also describes the progress of exploratory studies being conducted in cooperation with private industry on other specialized methods of fabricating beryllium wire - metal matrix composites, i.e., explosive bonding, spark sintering, ultrasonic diffusion bonding and plasma sprayed Be-Ti tapes. Author (GRA)

N71-35656# Aerospace Corp., El Segundo, Calif. Lab. Operations.
INFLUENCE OF THE SHAPE OF DISPERSED PARTICLES ON THE ELASTIC BEHAVIOR OF COMPOSITE MATERIALS
Ronald C. Rossi, James R. Coet, and Kenneth R. Janowski 1 Mar. 1971 23 p refs
(Contract F04701-70-C-0059)
(AD-726561; TR-0059(6250-10)-11; SAMSO-TR-71-135) Avail: NTIS CSCL 11/4

Young's modulus was measured on a series of composites of magnesium oxide containing low concentrations of graphite in the shape of flakes, fibers and nearly spherical particles. Comparison of the measured modulus with predictions of elastic behavior based on particle shape was in excellent agreement. The results indicate not only that accurate predictions of elastic moduli are possible, but also, that dispersed particle shape has a dominating influence on the elastic properties of composite materials at low concentrations of an included phase.
Author (GRA)

N71-35657# Naval Research Lab., Washington, D.C.
CHEMISTRY AND PHYSICS OF GLASS Semiannual Report, period ending 30 Jun. 1971
C. C. Klick Jun. 1971 28 p refs
(ARPA Order 418-9)
(AD-726416; SAR-8) Avail: NTIS CSCL 11/2

Results include the development of a platinum free laser glass, the discovery of several new radiation centers in borate glasses, evidence of local order in liquid chalcogenides, and the invention of a chalcogenide glass bolometer for broadband detection of infrared and microwave radiation. There was increased emphasis on the structural studies of glasses by means of X-ray and neutron diffraction and the initiation of a new program focussed on the mechanical properties of glasses. A new biaxial tensile testing facility was put into operation and programs are underway to develop high strength glasses by techniques such as ion implantation, valence variation, and surface coatings. Author (GRA)

N71-35658# Battelle Memorial Inst., Richland, Wash. Pacific Northwest Labs.
STRUCTURE PROPERTY RELATIONSHIPS IN LIQUID CERAMICS Final Report
Jewell J. Rasmussen, J. Lambert Bates, O. Daniel Slagle, and Richard P. Elson 21 Jun. 1971 42 p refs
(Contract N00014-67-C-0341)
(AD-726401) Avail: NTIS CSCL 11/3

Techniques were developed for measuring the volume change on melting, density, expansivity, surface tension, viscosity, and adiabatic compressibility of molten ceramics to temperatures as high as 3000 C. The techniques are extensions of more general methods used to measure liquid properties at lower temperatures. Modifications were made to reflect the severe conditions imposed by the high temperatures. The experimental conditions imposed limitations on the accuracy and precision of the surface tension data. Problems were also compounded by reaction between the sample and the crucible. The data which was obtained for the volume change on melting, density, viscosity, and adiabatic compressibility are quite precise considering the severe temperature conditions. The data for the systems studied are new except for some Al2O3 data. However, more data are required before the data can logically be used to interpret the liquid structures. One problem that was observed several times was the incompatibility of the sample with its container material. The elevated temperatures at melting produced rapid rates of reaction and capsule failure. The composite structures which were produced, however, do show potential promise for high temperature applications such as turbine blades or for electronic applications. Author (GRA)

N71-35659# Harry Diamond Labs., Washington, D.C.
RADIATION INDUCED CONDUCTIVITY IN n-HEXANE NEOHEXANE, AND SPECIAL POLYSTYRENE FILMS
Harold E. Boesch, Jr. and Edward E. Conrad May 1971 67 p refs
(AD-726353; HDL-TR-1537) Avail: NTIS CSCL 20/12

An investigation has been made of the transient electrical conductivity induced in special polystyrene films and liquid alkanes (n-hexane and neohexane) by radiation from a high-intensity flash X-ray machine. The polystyrene films were cast from solutions of polymers with a closely defined and narrow chain length distribution. Transient conductivity in the films was measured and was related to a kinetic model dominated by carrier trapping. The decay of radiation-induced conductivity in n-hexane and neohexane is described in terms of three time domains-an early (+200 nsec) exponential decay, an intermediate (+200 micro sec) nonohmic decay, and a late hyperbolic decay. The results of the study indicated no significant variation of the prompt induced conductivity with polymer molecular weight or sample temperature over the range of 150 to 300 K. The early conductivity exhibited hysteresis effects and low-field departures from ohmic behavior. The delayed conductivity decay showed a temperature dependence consistent with trap-hopping processes. In this region, samples of different molecular weight showed deviations from the hyperbolic decay mode. Author (GRA)

N71-35660# Aerospace Corp., El Segundo, Calif. Lab. Operations.
THE ELECTRONIC NATURE OF THERMAL CONDUCTION IN GRAPHITE AT VERY HIGH TEMPERATURES
Josef Kasper 1 Jun. 1971 32 p refs
(Contract F04701-70-C-0059)
(AD-726562; TR-0059(9250-02)-2; SAMSO-TR-71-131) Avail: NTIS CSCL 11/2

Recent measurements of the thermal diffusivity of graphites at high temperatures revealed that the diffusivity remains essentially constant in the temperature range from 2000 to 3000K. The possibility that this behavior may be due to an ambipolar electronic thermal conduction mechanism at these temperatures is discussed. Electrical resistance measurements indicate that the scattering of carriers is likely to be proportional to the square of the temperature in these regions. This, in turn, leads to large Lorenz numbers of the order of 10(k/e) to the 2nd power, as actually observed. Author (GRA)

N71-35661# Westinghouse Electric Corp., Pittsburgh, Pa.
THE EVALUATION OF GLASSES AS FORGING LUBRICANTS Technical Report, 1 Mar. - 30 Sep. 1970
A. T. Male, F. J. Gurney, and T. E. Jones Wright-Patterson AFB, Ohio AFML Apr. 1971 56 p refs
(Contract F33615-69-C-1198)
(AD-726583; AFML-TR-71-83) Avail: NTIS CSCL 11/8

The ring compression test was successfully used to determine the relative efficiency of a number of lubrication systems for the high temperature forging of Type 300A maraging steel and titanium-6 aluminum-4 vanadium alloy. The results clearly indicate the advantage of using both a glass coating on the workpiece and a grease-base lubricant on the tooling. Data obtained has identified the optimum temperature range for use of each of the three glass coatings evaluated. Inaccuracies in the application of theoretical analysis to practical ring test results, due to bulging occurring at high friction levels, can be minimized by using specimens of small ratios of internal diameter and thickness to external diameter. When such precautions are taken, the method of analysis used in this work allows a value for the interface shear of the lubricant system to be determined. Under thick film lubrication conditions, this value would be independent of the flow stress of the workpiece material. Author (GRA)

N71-35662# Air Force Systems Command, Wright-Patterson AFB, Ohio. Materials Lab.
PREPARATION AND CHARACTERIZATION OF A BENZOBISTRIAZO LOPHENANTHROLINE POLYMER Final Technical Report, May 1969 - Apr. 1970
Robert C. Evers Feb. 1971 42 p refs
(AD-726545; AFML-TR-70-306) Avail: NTIS CSCL 07/3

A benzobistriazolo phenanthroline polymer was prepared by the polycondensation of 2,6-pyridinediyldihydrazidine with 1,4,5,8-naphthalene tetracarboxylic acid or 1,4,5,8-naphthalene tetracarboxylic dianhydride in polyphosphoric acid. Inherent viscosities in the range of 0.25-0.87 dl./g. were recorded. Polymer structure was established by elemental and infrared analysis. The polymer was a reddish-brown powder soluble in sulfuric or methane sulfonic acid. Onset of breakdown during thermogravimetric analysis in a nitrogen atmosphere occurred at 475 C. Author (GRA)

N71-35663# Maryland Univ., College Park. Dept. of Chemistry.
SYNTHESIS OF LADDER OF DOUBLE CHAIN POLYMERS Final Report, 1 Mar. 1968 - 28 Feb. 1969
William J. Bailey 1971 15 p
(Grants DA-ARO(D)-31-124-G802; DA-ARO(D)-31-124-G1150)
(AD-726396; AROD-6068-3-C) Avail: NTIS CSCL 07/3

A number of ladder and spiro polymers have been synthesized and characterized. Author (GRA)

N71-35664# National Bureau of Standards, Washington, D.C.
A CHEMICAL INTERPRETATION OF STATIC FATIGUE
S. M. Wiederhorn Jun. 1971 36 p refs
(AD-726710; NBS-10444; TR-4) Avail: NTIS CSCL 11/2

The effect of crack tip environment on the fracture process in glass is discussed. It is suggested that the crack tip environment is determined by local chemical reactions between the crack surface and water at the crack tip. Crack extension is believed to be controlled by the crack tip hydroxyl ion concentration. Experimental support for these ideas is presented. Crack velocity data are consistent with an equation derived from the absolute rate theory of chemical reactions. The hydroxyl ion concentrations of ground glass water slurries are found to correlate with the velocity of crack motion in glass. Furthermore, the apparent activation energy for glass corrosion is found to be in reasonable agreement with that calculated from crack velocity and pH data. Experimental results are consistent with the suggestion that static fatigue is a stress corrosion process in which hydroxyl ions play an important role.
Author (GRA)

N71-35665# Army Natick Labs., Mass. Clothing and Personal Life Support Equipment Lab.
THE MECHANICAL PROPERTIES OF TEXTILE MATERIALS AS INFLUENCED BY STRUCTURE AND STRAIN RATE
Frank Figucia, Jr., Louis I. Weiner, and Roy C. Laible Apr. 1971 18 p refs
(AD-726920; C/PLSEL-TS-176; USA-NLABS-TR-71-51-CE) Avail: NTIS CSCL 11/5

Fibrous structures of increasing complexity, as introduced by ply and twist, were subjected to high and low speed tensile tests. The ratio of the strength at high speed to that at low speed is always greater than one but decreases with increasing complexity. The ratio of the elongation to break at high speed to that at low speed is always less than one and also decreases with increasing complexity of structure. The ability to absorb energy markedly increases with increasing complexity of geometry at the low strain rates characteristic of the Instron. The reasons for this additional energy absorbtion are discussed. Tests at high rates of straining point out the inability of many complex textile structures to translate their superior energy absorbtion characteristics to high strain rates. The results obtained and the principles demonstrated are applied to the development of improved materials for use in aerial delivery and ballistic applications.
Author (GRA)

N71-35666# Army Natick Labs., Mass. Clothing and Personal Life Support Equipment Lab.
RELATIONSHIP OF TENSILE AND TEAR STRENGTHS OF FABRICS TO COMPONENT YARN PROPERTIES
Vasant K. Devarakonda and Clarence J. Pope Aug. 1970 55 p refs
(AD-726919; C/PLSEL-TS-175; USA-NLABS-TR-71-50-CE) Avail: NTIS CSCL 11/5

The investigation was conducted on six selected fabrics to determine the relationship of breaking load, elongation and tear strength of fabrics to the properties of the component yarns. A system for expressing fabric properties as ratios of the contributing yarn properties was developed. Two factors termed cloth assistance factor (CAF) and cloth elongation factor (CEF) were used to characterize the effect of thread crossings in the fabric structure. These two factors show a linear relationship. It was concluded that the excess of fabric strength and elongation over that of yarn strength, elongation and crimp was due to the crossing threads effectivitely reducing the lengths of yarn elements in the test specimen thus localizing the rupture mechanism. Fabric tear strength and yarn strength were related through a third factor called tear efficiency factor (TEF). This factor defines the relationship between warp and filling tear strengths of the fabric in terms of the yarn strengths and threads per inch.
Author (GRA)

N71-35667 Pennsylvania State Univ., University Park.
NEW MATERIALS AND REACTIONS IN HIGH PRESSURE GAS-GLASS SYSTEMS
Samuel Purdy Faile (Ph.D. Thesis) 1969 142 p
Avail: Univ. Microfilms Order No. 70-19407

The synthesis and characterization of new glasses having a large concentration of unreacted gas as a component has produced information on the nature of glass. New gas-glass systems containing up to ten mole percent unreacted gas in physical solution were synthesized by the application of high pressure techniques. The synthesis generally involved the heating of glass to temperatures where the gas under high pressures up to ten kilobars readily diffused into the glass. After cooling to room temperature having maintained the high pressures, many materials can then be studied at normal atmospheric pressure without losing substantial amounts of the gas component. Some of these materials are B2O3-10% argon, SiO3-3% H2, and 81% B2O3-10% Li2O-6% BiO3-3% helium. The materials do not have a separate gas phase as shown by the absence of vesicles on high power electron micrographs. This indicates that it is possible to have a material consisting of large concentrations of both gas and glassy components.
Dissert. Abstr.

19 MATHEMATICS

Includes calculation methods and theory; and numerical analysis. For applications see specific categories. For related information see also 08 Computers.

N71-35668*# Auburn Univ., Ala. Dept. of Mathematics.
CERTAIN COMMENTS ON THE APPLICATION OF THE METHOD OF AVERAGING TO THE STUDY OF THE ROTATIONAL MOTIONS OF A TRIAXIAL RIGID BODY
Joseph J. F. Liu and Philip M. Fitzpatrick 2 Aug. 1971 38 p refs
(Grant NGR-01-003-036)
(NASA-CR-121986) Avail: NTIS CSCL 12A

Some results are described which were obtained when applying the averaging method to the variational equations describing the rotational motions of a rigid triaxial body about its center of mass, while the body is orbiting about, and influenced by, a second body. The discussion is based on several assumptions: (1) It was assumed that the rigid body moves in an elliptic orbit about an attracting point mass. (2) The rotational Kinetic energy of the rigid body was large compared to the effects of the perturbing gravitational potential. (3) The rotational rate of the body with respect to its center of mass is large when it is compared to both the orbital and orbital precession rates.
A.L.

N71-35669*# Texas A&M Univ., College Station. Graduate Inst. of Statistics.
MAXIMUM LIKELIHOOD ANALYSIS OF BALANCED INCOMPLETE BLOCK MODELS
Michael Henry Kutner Jul. 1971 61 p refs
(Grant NGR-44-001-095)
(NASA-CR-121894; TR-7) Avail: NTIS CSCL 12A

A structural form of the likelihood equations is developed, and the small-sample properties of maximum likelihood estimates is investigated. The matrix analysis of the fixed effects model is considered primarily for establishing notation and completeness. The mixed model is analyzed, and the relationship of maximum likelihood to analysis of variance is discussed. The recovery of interblock information is described in detail. The random model is analyzed, and the likelihood equations are solved numerically. A numerical comparison is included of the maximum likelihood estimates with Henderson's fitting constants estimates and estimates based on a minimum variance combination of the sufficient statistics. The relationship between Rao's estimation procedure and LaMotte's estimation procedure is also mentioned.
Author

N71-35670*# Texas A&M Univ., College Station. Graduate Inst. of Statistics.
WISHART VARIATE GENERATORS
W. B. Smith and R. R. Hocking Jul. 1971 6 p refs
(Grant NGR-44-001-095)
(NASA-CR-121888; TR-8) Avail: NTIS CSCL 12A

By using the Bartlett decomposition, subroutine WSHRT generates the matrix of sample variances and covariances from a random sample of size n distributed as a p-variate normal. The joint distribution of these sample variances and convariances is called the Wishart distribution. Author

N71-35671*# North Carolina State Univ., Raleigh.
CALCULUS OF VARIATIONS AND OPTIMAL CONTROL THEORY
Hans Sagan 1970 15 p refs Presented at the 49th Ann. Meeting of the Southeast Sect. of the Math. Assoc. of Am., Clemson, S. C., 20 Mar. 1970
(Grant NGL-34-002-032)
(NASA-CR-121907) Avail: NTIS CSCL 12A

The scope and applicability of the calculus of variations are reviewed with particular emphasis on its use in dealing with problems of optimal control theory. Included in the discussion are: the Euler-Lagrange problem, the Weierstrass condition, the multiplier rule, transversality conditions, Pontryagin's principle, and Filippov's lemma. D.L.G.

N71-35672*# California Univ., Berkeley. Operations Research Center.
CONVERGENCE RATES FOR A METHOD OF CENTERS ALGORITHM
Robert E. Mifflin May 1971 94 p refs
(Grants NGT-05-003-023; NSF GP-25081)
(NASA-CR-121911; ORC-71-10) Avail: NTIS CSCL 12A

Convergence of a method of centers algorithm for solving nonlinear programming problems whose feasible regions have nonempty strict interiors is considered. Conditions are given under which the algorithm generates sequences of feasible points and multiplier vectors which have accumulation points satisfying optimality conditions. Under stronger assumptions linear convergence rates are established for the sequences of objective function, constraint function, feasible point and multiplier values. The feasible points generated by the algorithm may be exact or approximate solutions to unconstrained maximization subproblems and in the approximate case may be found by finite step procedures. Upper bounds are derived for the number of steps required to solve each subproblem when the method of steepest ascent is employed. Author

N71-35673*# Massachusetts Univ., Amherst. Engineering Research Inst.
THE PARAMETER ADAPTIVE CONTROL OF UNKNOWN PLANTS
James W. Gilbert (Ph.D. Thesis) Jun. 1971 107 p refs
(Grant NGL-22-010-018)
(NASA-CR-121961; TR-6) Avail: NTIS CSCL 12A

Adaptive laws are developed by a technique of the parameter adaptive variety utilizing implicit plant identification. A modified adaptive rule is derived which results from the choice of a unique Liapunov function. A local stability analysis of the modified system is performed which shows that a more rapidly convergent error response is attainable. It is also shown that the high frequency oscillations in the plant outputs and adjustable parameters are not present when using the modified adaptive laws. Simulation results are given which demonstrate the flexibility afforded by the modified design. A separate discussion deals with the extension of the Liapunov parameter adaptive approach to plants with unknown time-varying parameters. Adaptive laws are derived which guarantee the global stability of the resulting system error. In addition, the results of the adaptive control of an optical tracking mount are presented. It is shown that the adaptive compensation of changing mount inertia and bearing friction results in increased tracking accuracy. D.L.G.

N71-35674*# Notre Dame Univ., Ind. Dept. of Electrical Engineering.
BINARY SEQUENCES WITH SPECIFIED CORRELATION PROPERTIES
Gerald Seguin (Ph.D. Thesis) 15 Aug. 1971 53 p refs
(Grant NGL-15-004-026)
(NASA-CR-121914; TR-7103) Avail: NTIS CSCL 12A

For any binary n-tuple, the functions E sub k and theta sub k are defined by F sub k + F sub n-k and F sub k - F sub n-k respectively, where F sub k is the usual k-th nonperiodic correlation coefficient of a sequence. It is shown that these two functions play a dominant role in bandwidth spreading signal schemes and general properties are developed. A cyclotomic sequence is defined and it is shown that for a given n such a sequence exists if and only if every cyclotomic coset of integers modulo n contains an even number of odd integers. In this case the number of sequences is exactly 2 raised to the number of cyclotomic cosets. It is shown that an infinite number of such integers exists. A self-dual sequence and a weakly Barker sequence are defined, and methods for constructing them are given. Results are also given about sequences obtained from arithmetic codes. Author

N71-35675*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
ON THE p-q GENERALIZED INVERSE
Dennis Addington Johnston (Ph.D. Thesis) Sep. 1971 124 p refs
(NASA-TM-X-58069) Avail: NTIS CSCL 12A

A calculation algorithm for the p-q solution of the degenerate linear system Y = AX is presented. A is an m x n linear transformation matrix with Y and X elements of the real m-dimensional and n-dimensional normed linear spaces V sub m and V sub n with function norm sub m and n respectively. Definitions, theorems, and proofs are included. Author

N71-35676*# North Carolina State Univ., Raleigh.
ON THE EXTENSION OF THE DAVIDON-BROYDEN CLASS OF RANK ONE, QUASI-NEWTON MINIMIZATION METHODS TO AN INFINITE DIMENSIONAL HILBERT SPACE WITH APPLICATIONS TO OPTIMAL CONTROL PROBLEMS
Terry Anthony Streeter (Ph.D. Thesis) 1971 104 p refs
(Grant NGL-34-002-032)
(NASA-CR-111975) Avail: NTIS CSCL 12A

The problem of minimizing a function by a rank one, quasi-Newton method is extended to infinite dimensional Hilbert spaces. A modification of the rank one, quasi-Newton methods in order to minimize a functional subject to linear constraints is also considered. Conditions are found which guarantee the convergence to the location of the constrained minimum of a quadratic functional. The application of these rank one, quasi-Newton algorithms to various classes of optimal control problems is investigated. Also, the algorithms are applied to a sample optimal control problem. The results are compared with the results for the same problem using other known first-order minimization techniques. Author

N71-35677*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SLEWING ABOUT NON-ORTHOGONAL AXES
Paul B. Davenport Jul. 1971 21 p refs Presented at AAS/AIAA Astrodyn. Specialists Conf., Ft. Lauderdale, Fla., 17-19 Aug. 1971
(NASA-TM-X-65688; X-841-71-274) Avail: NTIS CSCL 12A

Given a desired three-axis orientation, it is well known that there are (in general) twenty-four possible three-legged slews about orthogonal axes which will perform the re-orientation. The material presented determines whether the maneuver may be accomplished with three slews about arbitrary (not necessarily orthogonal) axes. All of the possible three-legged slews are exhibited by a closed analytical procedure which requires no assumptions concerning the degree of non-orthogonality nor any

approximations. The classical orthogonal case (Euler angles) is then an immediate consequence as a special case of the generalized solution. The development also includes the solutions of single-axis re-orientations by two successive rotations about arbitrary fixed lines. Author

N71-35678*# Massachusetts Inst. of Tech., Cambridge. Measurement Systems Lab.
THE TRANSFORMATION OF A SERIES EXPANSION IN SOLID SPHERICAL HARMONICS UNDER TRANSLATION AND ROTATION OF COORDINATES
William Nelson Lee (M.S. Thesis) Jun. 1971 85 p refs
(Contract NAS9-8328)
(NASA-CR-115141; TE-47) Avail: NTIS CSCL 12A

The necessary transformation formulas are developed and applied to the task of analytically calculating the force between two homogeneous hemispheres. Two special cases are worked out in detail as examples where the coordinate changes involve both translation and rotation. Author

N71-35679# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
SELF-ADJUSTING NUMERICAL CONTROL OF A LINEAR SYSTEM: APPLICATION TO A SECOND-ORDER SYSTEM [COMMANDE AUTO-ADAPTIVE NUMERIQUE D'UN SYSTEME LINEAIRE: APPLICATION A UN SYSTEME DU SECOND ORDRE]
Huu Thanh Huynh 1970 83 p refs In FRENCH
(ONERA-P-134) Avail: NTIS

A method for the numerical self-adjustment of the control of a linear system involving minimization of a quadratic performance index is described. The method calls for the characteristic system parameters to be identified; this is effected here by the method of quadratic minimization. The case of an incomplete observation of the state of the system is also considered. For control, a sub-optimal law is put forward as a substitute for the optimal law, which is inapplicable to self-adjustment. An example of a second-order system is discussed to illustrate the method. Author

N71-35680# Technische Hogeschool, Eindhoven (Netherlands).
RECURRENCE PROPERTIES AND PERIODICITY FOR MARKOV PROCESSES
Frederik Hendrik Simons (Ph.D. Thesis) Jun. 1971 151 p refs
Avail: NTIS

The material presented includes the following: (1) A systematical outline is given of the Markov processes induced by a measurable transformation. In particular, a representation theorem for the backward processes is obtained. (2) Some properties of Markov measures on product spaces and of Markov shifts are studied. A collection of well-known facts on conservativity of Markov processes is given, and conservativity is treated for backward processes induced by ergodic measure preserving transformations in a probability space. (3) A general definition of periodicity and aperiodicity for Markov processes is dealt with. In particular, a characterization of the essential part by means of invariant sets is given. D.L.G.

N71-35681# Technische Hogeschool, Eindhoven (Netherlands).
CONDITIONAL MEAN INFORMATION AND CONDITIONAL MEAN ENTROPY
Arthur Gabriel Paul Maria Nijst (Ph.D. Thesis) Jun. 1971 131 p refs
Avail: NTIS

Let (X,R,P,) be a probability space with X being an abstract set, R a sigma field of subsets of X, and P a probability on R. Some conditions are investigated on the tranformation T and on the sub-sigma-field R sub zero of R which guarantee the existence of conditional mean information and conditional mean entropy for any partition xi with finite entropy with respect to R sub zero. Some properties of conditional mean information and conditional mean entropy are established for cases in which: (1) T is measure preserving but not necessarily invertible; (2) T admits an invariant probability P' equivalent to P for a finite partition xi 1 and conditioning by an invariant sub-sigma-field R sub zero of R; and (3) T is invertible but not necessarily measure preserving. D.L.G.

N71-35682# Royal Inst. of Tech., Stockholm (Sweden).
ON THE NUMERICAL TREATMENT OF SOME INTEGRO-DIFFERENTIAL EQUATIONS, FOURIER INTEGRALS, AND INTEGRAL EQUATIONS
Bo Einarsson (Ph.D. Thesis) Mar. 1971 24 p refs
Avail: NTIS

A certain integro-differential equation, arising in applied mechanics, is studied. The characteristic property of this equation is that the time derivative is negative at the maximum points with respect to the space variable. This property C will be used both in analyzing the equation and in obtaining the numerical solution. If certain conditions are satisfied the solution will tend to a constant. Realistic error bounds are given. Applications of the spline approximation are given. Fourier integrals are calculated by means of a spline fit, and the errors are studied both experimentally and theoretically. A complete FORTRAN algorithm, where repeated Richardson extrapolation is used for the calculation of the integrals, is given. The numerical solution of Abel's integral equation with spline functions is studied and a method that incorporates a least squares method is recommended. Author

N71-35683# Joint Publications Research Service, Washington, D.C.
EXISTENCE OF A VALUE FOR A DIFFERENTIAL GAME WITH PRESCRIBED DURATION
B. A. Shoykhet 2 Sep. 1971 10 p refs Transl. into ENGLISH from Kibernetika (Kiev), no. 2, 1971 p 119-124
(JPRS-53973) Avail: NTIS

The differential game examined is described by the system of equation dx/dt = f(s,u(t),v(t)). The vector function f(x,u,v) is defined for given set conditions, and is considered to satisfy the local Lipshitz condition for x and to be continuous for the sum total of its independent variables. The controls of players P and E and for the time interval are designated, and separate strategies are defined for players P and E. It is stipulated that the right hand side of the initial equation must contain f(x,u,v) where f(x,u,v) = f1(x,u) + f2(x,v). N.E.N.

N71-35684# Joint Publications Research Service, Washington, D.C.
CERTAIN PROBLEMS OF ADAPTIVE CONTROL
G. D. Penev et al 2 Sep. 1971 5 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 198, no. 4, 1971 p 787-790
(JPRS-53972) Avail: NTIS

A mathematical discussion is given on the adaptive control problem illustrated by constructing a robot cyclist which should train itself to ride the bicycle at a constant velocity. Theorems are proved and then used in a computerized simulation in which the robot fell six times and learned to ride beginning with the seventh game. N.E.N.

N71-35685# University of Southern Calif., Los Angeles. Dept. of Electrical Engineering.
STOCHASTIC BEHAVIOR OF A REPLACEMENT SYSTEM
Shunji Osaki May 1971 10 p refs
(Grant GM-16197-03)
(TR-71-24) Avail: NTIS

A simple replacement system is discussed under the assumptions that the failure and the replacement time distributions are both arbitrary. In this system it is assumed that failure is discovered only by replacement. The transition probabilities and the limiting probabilities are derived by using a unique modification of Markov renewal processes. Computational considerations are finally presented. Author

N71-35686# Syracuse Univ., N.Y.
A STUDY OF GENERAL RELATIVITY IN CANONICAL FORM
Frederick S. Klotz (Ph.D. Thesis) Aug. 1970 114 p refs
Avail: NTIS

Positivity and constraint relations are examined for the canonical form of the general relativity theory.These restrictions are considered as an indication that the original canonical variables are not appropriate for the theory. New dynamical variables which are not subject to such conditions are introduced by means of a canonical transformation. The consideration of several different programs for simplifying the canonical formulation of the initial value problem for general relativity resulted in the development of a constraint free form for the canonical field equations of general relativity. The meaning of the results are discussed for the quantization program. Author

N71-35687*# Scientific Translation Service, Santa Barbara, Calif.
NUMERICAL APPLICATION OF ONE NEW APPROXIMATE METHOD FOR SOLVING BOUNDARY VALUE PROBLEMS
M. A. Aleksidze Washington NASA Sep. 1971 191 p refs Transl. into ENGLISH from the publ. "Chislennaya realizatsiya odnogo novogo priblizhennogo metoda resheniya granichnykh zadach" Tbilisi, Metsniyereba, 1969
(Contract NASw-2035)
(NASA-TT-F-659) Avail: NTIS CSCL 12A

Questions involved in the numerical application of the method of functional equations for solving boundary value problems are analyzed and general purpose programs are derived. Author

N71-35688*# Brown Univ., Providence, R.I. Center for Computer and Information Sciences.
COMPUTATIONAL WORK AND TIME ON FINITE MACHINES
J. E. Savage Jun. 1971 48 p refs
(Contract NAS7-100; Grants NGR-40-002-082; NGR-40-002-080; NSF 13162)
(NASA-CR-121930) Avail: NTIS CSCL 12A

Measures of the computational work and computational delay required by machines to compute functions are given. Exchange inequalities are developed for random access, tape and drum machines to show that product inequalities between storage and time, number of drum tracks and time, number of bits in an address and time, etc., must be satisfied to compute finite functions on bounded machines. Criteria for the design and use of general purpose computers are developed, and applications of the exchange inequalities are made to the language recognition problem. Author

N71-35689# Aeronautical Research Labs., Melbourne (Australia).
THE DISTRIBUTION OF ROUNDING ERROR
R. C. Adams Dec. 1970 30 p refs
(ARL/SM-328) Avail: NTIS

The calculation is presented of error probabilities for numerical computations when the errors arise from rounding. Error probability density distributions are calculated for the basic arithmetical operations of addition, multiplication and division of fixed-length binary floating and fixed point numbers. The error distribution is proved to be asymptotically normal except in certain adverse conditions. The approach to a normal distribution is examined analytically by means of a series expansion and numerically, for fixed point arithmetic only, by calculating the distributions. It is shown that the rate of approach to a normal distribution is quite rapid and that the greatest departures occur in the tails of the distribution. It is also shown that regardless of whether the distribution is normal or not the standard deviation may always be computed, usually with no more effort than the extreme error bounds. The standard deviation is a satisfactory guide to the probable error of the result. Under conditions when the distribution is known to be close to normal the probability of any reasonably likely error may then be calculated. Author

N71-35690# Research Inst. of National Defence, Stockholm (Sweden).
COMPENSATION OF A BANG-BANG SYSTEM WITH HYSTERESIS AND THRESHOLD VALUES [KOMPENSERING AV ETT BANG-BANG-SYSTEM MED HYSTERES OCH TROESKELVAERDE]
S. Jahnberg Feb. 1970 31 p refs In SWEDISH
(FOA-2-C-2371-54) Avail: NTIS

The modification of a missile control system with bang-bang characteristics is discussed. A three position guidance is introduced instead of pure bang-bang guidance in order to conserve the working material. The system is stabilized by nonlinear compensation of the bang-bang system. Author

N71-35691# University of Southern Calif., Los Angeles. Dept. of Electrical Engineering.
A NOTE ON TWO-UNIT REDUNDANT REPAIRABLE SYSTEMS
Shunji Osaki Jun. 1971 6 p refs
(Grant GM-16197-03)
(TR-71-26) Avail: NTIS

The first passage time distributions are derived for two models of two-unit redundant repairable systems when failures are detected, by using Markov renewal processes. Error corrections are included for the second model. J.M.

N71-35692# University of Southern Calif., Los Angeles.
TOPICS IN PHARMACOKINETICS. 4: APPROXIMATION IN PROCESS SPACE AND FITTING BY SUMS OF EXPONENTIALS
Richard Bellman Aug. 1971 6 p refs
(Grant GM-16197-03)
(TR-71-32) Avail: NTIS

An extension of differential approximation is presented for application to structure space in pharmacokinetics. Fitting by sums of exponentials is outlined for compartmental models of physical processes which can be described by linear differential equations. J.M.

N71-35693# University of Southern Calif., Los Angeles.
INITIAL PROVISIONING OF A STANDBY SYSTEM WITH DETERIORATING AND REPAIRABLE SPARES
David L. Jaquette and Shunji Osaki Jul. 1971 12 p refs
(Grant GM-16197-03)
(TR-71-31) Avail: NTIS

A technique is developed and discussed for finding the time dependent operating probabilities used by reliability systems designers for provisioning a system with N + k identical units, k of which are called spares and N called operating units, and a repair facilities. System failure occurs when less than N units are operational. Units fail with exponential inter-failure times and can be repaired with exponential service time. Idle spares fail due to deterioration at a rate possibly different than that of the operating units. Graphs are presented which show the minimum numbers of spares needed to achieve system reliabilities of 90 and 99% as a function of time, t. The technique described is applicable for finding, numerically, the first passage time distribution for any system modeled by birth and death processes. Author

N71-35694# University of Southern Calif., Los Angeles. Dept. of Electrical Engineering.
IRREGULAR REGIONS AND CONSTRAINED OPTIMIZATION
Edward Angel Jun. 1971 22 p refs
(Grant NSF GP-20423; Contract AT(11-1)-1113)
(USC-113P19-10; TR-71-27) Avail: NTIS

Direct methods for the numerical solution of elliptic equations over irregular regions are discussed. An irregular region is considered to be imbedded in a conveniently chosen rectangle. The variational problem corresponding to the given

partial differential equation is used. In this way the problem is formulated, for linear elliptic equations, as a quadratic programming problem. Dynamic programming is used to solve a discretized version of the problem. The method is shown to be very general and to have favorable stability properties. Author

N71-35695# Brown Univ., Providence, R.I. Engineering Div.
A SECOND ORDER ACCURATE DIFFERENCE METHOD FOR SYSTEMS OF HYPERBOLIC PARTIAL DIFFERENTIAL EQUATIONS
S. Ranganath and R. J. Clifton Wright-Patterson AFB, Ohio AFML May 1971 33 p refs
(Contract F33615-70-C-1101)
(AD-726549; AFML-TR-71-106) Avail: NTIS CSCL 12/1

A second order accurate difference method is presented for systems of first order hyperbolic differential equations. The method is analogous to the Courant, Isaacson, Rees (CIR) method, except that the error introduced in one time step is O(delta t cubed) instead of O(delta t squared) as is the case for the CIR method. Convergence of the proposed method is established. The cumulative error at a fixed time is shown to be O(delta t squared). The proposed method is compared with several other second order accurate methods by considering in detail the special case of the system of equations governing flexural wave propagation in elastic beams. These comparisons indicate that the proposed method has substantial advantages over the other methods considered in that the method is computationally stable for larger mesh sizes. As a result, less computing time is required to obtain solutions with a given accuracy. Author (GRA)

N71-35696# Harvard Univ., Cambridge, Mass. Computer Graphics and Spatial Analysis Lab.
GEOGRAPHY AND THE PROPERTIES OF SURFACES. THE SANDWICH THEOREM: A BASIC ONE FOR GEOGRAPHY Interim Report
William Warntz, C. Ernesto S. Lindgren, Katherine Kiernan, Luisa Bonfiglioli, and Eduardo Lozano 30 Jun. 1971 91 p refs
(Contract N00014-67-A-0298-0004)
(AD-726403; ONR-TR-44; Paper-44) Avail: NTIS CSCL 12/1

The Sandwich Theorem is a fundamental one for geography. It provides the limiting conditions concerning spatial partitioning. As a theorem it provides information concerning the existence of solutions but not analytical means for finding them. This paper provides geometrical interpretations of the nature of the Sandwich Theorem and its relationship to Geography and provides an algorithm and a complete program to achieve solutions. Also included is a translation of one work of Hugo Steinhaus. Author (GRA)

N71-35697# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio. Applied Mathematics Research Lab.
EXACT DISTRIBUTIONS OF A FEW ARBITRARY ROOTS OF SOME COMPLEX RANDOM MATRICES Final Report
V. B. Waikar, T. C. Chang (Cincinnati Univ.), and P. R. Krishnaiah Feb. 1971 19 p refs
(AD-726694; ARL-71-0035) Avail: NTIS CSCL 12/1

In this paper, the authors derived expressions for the joint probability density of any few unordered roots of a class of noncentral complex random matrices. This class includes A-matrix which is of interest to physicists, Wishart matrix, MANOVA matrix and canonical correlation matrix. Author (GRA)

N71-35698# Pennsylvania Univ., Philadelphia. Moore School of Electrical Engineering.
SOME RESULTS IN TREE AUTOMATA
L. S. Levy and A. K. Joshi 1971 16 p refs
(Contract DA-31-124-ARO(D)-98; Grants NSF GJ-27; NSF GS-2509)
(AD-726393; Rept-71-26; AROD-4166-25-M; Rept-7126) Avail: NTIS CSCL 06/4

The following three results concerning tree automata are presented in this paper: Rounds has presented the following open problem: For every recognizable set R, can one construct a deterministic finite state transformation recognizing R. The authors show that this is not possible, in fact, even for a local set. However, the following is true: For every recognizable set, R, there is an inverse projection, R primed effectively obtained, such that R primed is recognized by a deterministic finite state transformation. Martin and Vere in their study of tree automata leave open the question of whether Generalized Syntax Directed Transductions are closed under Arden's transformation or Greibach's transformation, and conjecture that they are not. The authors prove that this conjecture is true. Peters and Ritchie have shown that if in a grammar where the generative rules are context-free, there are recognition rules which are context sensitive, the language recognized is still context free. A tree automata oriented proof is given by Rounds. The authors show that a similar result holds also for right linear grammers. Author (GRA)

N71-35699 Pennsylvania State Univ., University Park.
A METHOD FOR NUMERICAL SOLUTION OF ENGINEERING PROBLEMS IN OPTIMAL PROGRAMMING
Garrett John Thrasher (Ph.D. Thesis) 1969 236 p
Avail: Univ. Microfilms Order No. 70-16224

This model includes multiple control variables and multiple points of state discontinuity. Initial conditions are of the system specified; the final state of the system is either specified, left free or extremized giving rise to a calculus of variations problem of the Mayer type. Practical engineering considerations are introduced in the problem in the form of state and control variable inequality constraints. The subject numerical method is intended as a unified, user-oriented approach to the satisfaction of the first order necessary conditions for extremizing the performance of state- and control-constrained, multistage dynamical systems. The work is devoted primarily to the numerical treatment of state and control variable inequalities and state variable discontinuities in optimal control problems. Several example problems are treated in detail to illustrate the use and effectiveness of the general numerical method. Dissert. Abstr.

N71-35700 Washington Univ., Seattle.
ACCELERATION OF CONVERGENCE OF ITERATIVE METHODS FOR THE SOLUTION OF EQUATIONS
David G. Carta (Ph.D. Thesis) 1970 136 p
Avail: Univ. Microfilms Order No. 70-189-41

Accelerations are developed for Newton's method and the secant method. A general approach based on the acceleration for Newton's method allows us to produce an accelerated version of any superlinearly convergent iterative method whose asymptotic error relation is known. A family of extremely simple and computationally convenient iterative methods for finding roots, turning-points, inflection-points, etc., without the explicit calculation of derivatives was found. A second family of methods was then found which in a certain sense are self-accelerating versions of the original methods and have higher order asymptotic convergence rates. An attempt to extend the acceleration concepts developed for scalar iterative methods to systems of nonlinear equations was not directly successful. However, another method which employs techniques from systems identification, least squares, and exponential smoothing was developed. Dissert. Abstr.

N71-36266*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
GUYAN REDUCTION SOLUTIONS RECYCLED FOR IMPROVED ACCURACY
Roy Levy *In* NASA. Langley Res. Center NASTRAN: Users Experiences Sep. 1971 p 201-220 refs (See N71-36253 22-32)
(Contract NAS7-100)
Avail: NTIS HC $9.00/MF $0.95 CSCL 12A

N71-36278*# Teledyne Brown Engineering, Huntsville, Ala.
COMPLEX EIGENVALUE SOLUTION TO A SPINNING SKYLAB PROBLEM
Jayant S. Patel and S. M. Seltzer (NASA. Marshall Space Flight Center) *In* NASA. Langley Res. Center NASTRAN: Users Experiences Sep. 1971 p 439-449 ref (See N71-36253 22-32)
Avail: NTIS HC $9.00/MF $0.95 CSCL 12A

20 METEOROLOGY

Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences.

N71-35701*# United Aircraft Corp., East Hartford, Conn. Research Labs.
ADDITIONAL RESEARCH ON INSTABILITIES IN ATMOSPHERIC FLOW SYSTEMS ASSOCIATED WITH CLEAR AIR TURBULENCE
Richard C. Stoeffler Aug. 1971 105 p refs
(Contract NASw-1582)
(NASA-CR-122041; K910563-19) Avail: NTIS CSCL 04B

An open water channel was used which allowed investigation of flows having wide ranges of shear and density stratification. The stability of straight, stratified shear flows were studied with particular emphasis on three-dimensional effects on the break-down region in shear layers; the interaction of shear flows with long-wavelength internal waves; the stability of shear flows consisting of adjacent stable and unstable layers; and turbulent wake collapse effects in shear flows. The results of the studies were used to evaluate methods used in analyses of clear air turbulence (CAT) in the atmosphere involving wave-induced shear layer instabilities of the Kelvin-Helmholtz type. A computer program was developed for predicting sheer-layer instability and CAT induced by mountain waves. The technique predicts specific altitudes and locations where CAT would be expected. Author

N71-35702# Bureau of Reclamation, Denver, Colo. Div. of Atmospheric Water Resources Management
PROJECT SKYWATER Atmospheric Water Resources Program, Annual Report, 1970
R. L. Eddy, comp. Feb. 1971 498 p refs
(REC-ERC-71-2) Avail: NTIS HC $6.00/MF $0.95

Details are given on weather modification programs undertaken to provide precipitation management technology for use in solving the nation's water resources problems. Summary data are presented on winter field programs, summer field programs, nonfield programs, pilot projects, and contractor reports. For individual titles, see N71-35703 through N71-35729.

N71-35703# Bureau of Reclamation, Denver, Colo.
PROJECT SKYWATER: PHILOSOPHY AND HIGHLIGHTS OF 1970
In its Proj. Skywater Feb. 1971 p 1-12 (See N71-35702 22-20)
Avail: NTIS HC $6.00/MF $0.95

The work in developing and managing the water resources of the Western U.S. is reported. The Colorado River Basin Pilot Project and the Northern Great Plains Project are briefly described, and the seeding programs, ecological goals, and meteorological parameters conducive to precipitation are discussed. F.O.S.

N71-35704# Aerometric Research, Inc., Goleta, Calif.
LARGE SCALE DYNAMIC EFFECTS OF CLOUD SEEDING Interim Report, 1 Nov. 1969 - 30 Jun. 1970
In Bur. of Reclamation Proj. Skywater Feb. 1971 p 13-28 refs (See N71-35702 22-20)
(Contract DI-14-06-D-6841)
Avail: NTIS HC $6.00/MF $0.95

The investigations are reported for detecting changes in the large scale precipitation patterns of randomized seeding in the Santa Barbara, California area. The methods of seeding, and data acquisition are described. A preliminary result indicates a ratio of 10 to 1 of heavier precipitation for seeded areas compared to nonseeded areas. F.O.S.

N71-35705# Colorado State Univ., Fort Collins.
DIFFUSION
In Bur. of Reclamation Proj. Skywater Feb. 1971 p 29-60 refs Supported by Dept. of Interior (See N71-35702 22-20)
Avail: NTIS HC $6.00/MF $0.95

The research and tentative results are reported concerning the problem of using scaled topographic models and laboratory techniques to study the transport and dispersion of cloud seeding material over mountainous terrain. Three mountainous areas along the continental divide were selected by the Bureau of Reclamation for such studies. Each area has field cloud seeding programs in progress. Results from the field and model for the Eagle River Valley-Climax area showed the following similarities between field and model: (1) The principal valley was filled with tracer material. (2) The angle of inclination at which the tracer material leaves the generator sites was between 60-80 degrees with respect to the terrain. (3) The direction of the tracer plume was approximately the same. (4) Partial similarity was achieved for the horizontal and vertical dispersion of the tracer material with the model airflow consisting of a vertical temperature distribution approximately similar to the field. Author

N71-35706# Colorado State Univ., Fort Collins.
ECOLOGY, PHASE 1 Final Report
In Bur. of Reclamation Project Skywater Feb. 1971 p 61-78 Supported by Dept. of Interior Prepared in cooperation with Colo. Univ., Boulder. Inst. of Arctic and Alpine Res. and Ft. Lewis Coll., Durango, Colo. Div. of Biol. Sci. (See N71-35702 22-20)
(Contract DI-14-06-D-6862; San Juan Ecology Proj.)
Avail: NTIS HC $6.00/MF $0.95

The ecological consequences of winter cloud seeding in the San Juan area of the Colorado River Basin were studied. The effects on the following were considered: consumers, decomposers, abiotic factors, forest ecosystem, and aquatic ecosystem. It is concluded that any effects of increased snow on the ecosystems will be small, and may not be apparent for many years. F.O.S.

N71-35707# Colorado State Univ., Fort Collins.
EQUIPMENT: DESIGN AND DEVELOPMENT OF GROUND TYPE SILVER IODIDE GENERATORS
In Bur. of Reclamation Proj. Skywater Feb. 1971 p 79-90 Supported by Dept. of Interior (See N71-35702 22-20)
Avail: NTIS HC $6.00/MF $0.95

The design, development, and evaluation of a steady state ice nuclei generator (ground and airborne) for field application is reported. The design parameters including nucleating materials, carriers, and fuels are described. Performance charts showing effectiveness as nuclei/gram AgI versus temperature are included. F.O.S.

N71-35708# Colorado State Univ., Fort Collins.
HYDROLOGY Summary Report, 1 Jul. 1968 - 30 Jun. 1970
In Bur. of Reclamation Proj. Skywater Feb. 1971 p 91-103 refs Sponsored by Bur. of Reclamation (See N71-35702 22-20)
Avail: NTIS HC $6.00/MF $0.95

The work in developing techniques for determining the hydrologic stability of regions considered for precipitation management, and for evaluating the results of future programs is reported. The achievements in the following areas are discussed:

daily runoff as a test variable, optimal grouping of basins, multiple target-control test, hydrologic data system, and hydrologic data analysis. It is concluded that a positive hydrologic evaluation can be achieved for the Colorado River Basin Project. F.O.S.

N71-35709# Colorado State Univ., Fort Collins.
PLANNING: DESIGN OF AN OPERATIONAL ADAPTATION PROGRAM FOR THE COLORADO RIVER BASIN Interim Report, Jul. 1969 - Jun. 1970
In Bur. of Reclamation Proj. Skywater Feb. 1971 p 105-122 (See N71-35702 22-20)
(Contract DI-14-06-D-6467)
Avail: NTIS HC $6.00/MF $0.95

The work in designing a pilot program for operational weather modifications in the Colorado River Basin is reported. Developments in the following areas are discussed: orographic cloud model, input soundings, geography, climatology, and hydrology. F.O.S.

N71-35710# Colorado State Univ., Fort Collins.
STATISTICS
In Bur. of Reclamation Proj. Skywater Feb. 1971 p 123-136 refs Supported by Dept. of Interior (See N71-35702 22-20)
Avail: NTIS HC $6.00/MF $0.95

The design of weather modification experiments is discussed in terms of the statistical analysis of results. Sampling procedures, and selection of meteorological variables that affect cloud seeding are presented along with a numerical example of the rank tests. F.O.S.

N71-35711# Edgerton, Germeshausen and Grier, Inc., Bedford, Mass.
[CLOUD-SEEDING-OPPORTUNITY FORECASTING TECHNIQUES, PHASE 1]
In Bur. of Reclamation Proj. Skywater Feb. 1971 p 137-153 refs Supported by Dept. of Interior (See N71-35702 22-20)
Avail: NTIS HC $6.00/MF $0.95

Data and findings are reported of work performed during Phase 1 of the Colorado River Basin Pilot Project. Development of forecasting techniques tailored specifically to project seeding opportunity was accomplished. Results indicate: (1) strong dependence of area precipitation patterns on 700 mb wind direction, directionally dependent terrain slope, direction dependent mixing ratio values, and large scale vertical motion fields; (2) precipitation occurrence and amount is jointly dependent on 500 mb vorticity change and 700 mb dewpoint depression; and (3) 700 mb temperature can be used as a guideline to prevent overforecasting of precipitation amounts during periods of strong dynamics but cold temperature. Preliminary studies of avalanche occurrence indicate dependence on precipitation amounts, and for thawing type avalanches, on 700 mb temperature. Last winter and early spring airborne diffusion studies in the San Juan mountains of ground-released AgI and ZnS indicated wider and more vertically homogeneously mixed plumes than predicted by the Gaussian Pasquill-Gifford diffusion equation, and a notable absence of low level trapping temperature inversions. A study of radiosonde data also indicated no trapping inversions during wet periods except occasionally, immediately above the Animas Valley floor. Author

N71-35712# Environmental Science Services Administration, Washington, D.C.
[CLOUD SEEDING: INVESTIGATION, ANALYSES, AND EXPERIMENTS]
In Bur. of Reclamation Proj. Skywater Feb. 1971 p 155-174 refs Supported by ESSA (See N71-35702 22-20)
Avail: NTIS HC $6.00/MF $0.95

Data analyses and numerical results of the 1968 Florida cumulus seeding project are briefly summarized. Topics discussed include: assessment of the potential applications of cold cumulus seeding, possible large-scale effects of seeding single clouds, and design of multiple cloud seeding experiment for South Florida. F.O.S.

N71-35713# Fresno State Coll. Foundation, Calif.
[WATER SUPPLY AUGMENTATION IN THE SIERRA NEVADA OF CALIFORNIA] Research Report, Fiscal Year 1970
In Bur. of Reclamation Proj. Skywater Feb. 1971 p 175-200 refs Sponsored by Bur. of Reclamation (See N71-35702 22-20)
Avail: NTIS HC $6.00/MF $0.95

The research activities for increasing water supplies in the Sierra Nevada of California are reported. These activities included full-scale field experimentation during the winter season which involved a total of 14 test case storms. A number of related studies of a hydrological-climatological nature were also conducted both in support of the basic goals and as separate investigations. Author

N71-35714# Harvard Univ., Cambridge, Mass.
DECISION AND INSTITUTIONAL ASPECTS OF WEATHER MODIFICATION
In Bur. of Reclamation Proj. Skywater Feb. 1971 p 201-225 refs Supported by Dept. of Interior (See N71-35702 22-20)
Avail: NTIS HC $6.00/MF $0.95

Legal aspects of weather modification and its associated economic consequences are studied to develop private law doctrines. Federal control of modification activities are discussed along with proof of causation and assessment of damages. A federally administered insurance fund for compensating damages associated with weather modification activities is also discussed. It is concluded that there is strong support for the need of federal legislation. F.O.S.

N71-35715# Illinois State Water Survey, Urbana.
[QUANTITATIVE ESTIMATES OF THE POTENTIAL EFFECTS OF CLOUD SEEDING ON CROP PRODUCTION]
In Bur. of Reclamation Proj. Skywater Feb. 1971 p 227-238 refs (See N71-35702 22-20)
(Contract DI-14-06-D-6843)
Avail: NTIS HC $6.00/MF $0.95

The research to provide quantitative estimates of the potential effects of cloud seeding on crop production is discussed. Evaluation of agricultural potential benefits are being confined to the two major Illinois crops, corn and soybeans. Three basic tasks were undertaken. These include: (1) determination of weather-yield relationships for corn and soybeans in Illinois with division of the state into regions of equivalent yield characteristics, (2) development of methods to evaluate quantitatively the effect of seeding-induced rainfall changes on yields of these crops, and (3) preliminary assessment of the economic value of yield increases resulting from cloud seeding. Results of the initial analysis for the pilot study are graphed, and indicate frequency distributions of yield changes from one to five years. Author

N71-35716# Meteorology Research, Inc., Altadena, Calif.
[THE POTENTIAL OF ISOLATED CUMULI AS TARGETS FOR PRECIPITATION AUGMENTATION] Research Reports on the Arizona Weather Modification Research Program, Fiscal Year 1970
In Bur. of Reclamation Proj. Skywater Feb. 1971 p 239-263 refs Supported by Dept. of Interior (See N71-35702 22-20)
Avail: NTIS HC $6.00/MF $0.95

The activities in seeding isolated cumuli to increase precipitation in Arizona are reported. Research topics presented include: (1) steady-state cumulus model, (2) hydrometeor development in small Flagstaff cumuli, (3) ice nuclei measurements, (4) contact nucleation model for seeded clouds, (5) seedability climatology of the Western US, and (6) case study of a seeded storm system. It is recommended that with any pilot program, research in seeding optimization and cloud population size distribution be pursued. Author

N71-35717# New Mexico State Univ., University Park.
[RANDOMIZED SEEDING EXPERIMENTAL PROGRAM]
In Bur of Reclamation Proj. Skywater Feb. 1971 p 265-285 refs Supported by Dept. of Interior (See N71-35702 22-20)
Avail: NTIS HC $6.00/MF $0.95

During the winter of 1969-1970 a randomized seeding experimental program was conducted in the Sierra Nacimiento and Jemez Mountains near Cuba, New Mexico. Silver iodide ground generators, modified and mobile versions of the Skyfire type, were used. The number and location of nuclei generating equipment to produce active nuclei within the target were determined. The meteorological aspects of the program consisted of detailed analysis of winter storms of the southern Rocky Mountains that cross the experimental area. To do this, 243 radiosonde flights were attempted and 213 were not successfully completed. A mathematical model was used to objectively predict seedable units. The model predicted correctly 102 times in the 151 days of November through March. The meteorological parameters associated with the Jemez storm systems were defined and measured. Field precipitation measurements were collected to evaluate the randomized seeding program and diffusion patterns for specific locations of nuclei. Recording snow precipitation stations were used to measure variation of precipitation in space and time. Precipitation in November, December, January, February, and March was approximately 1.25, 1.50, 0.3, 0.5, and 4.1 equivalent inches of water, respectively. Precipitation distribution varied greatly in time and space. Author

N71-35718# New York Univ., N.Y.
SOME MEASUREMENTS OF THE SPATIAL DISTRIBUTION OF ATMOSPHERIC WATER VAPOR BY MEANS OF A TUNEABLE PULSED LASER RADAR SYSTEM
In Bur. of Reclamation Proj. Skywater Feb. 1971 p 287-305 refs Supported by Dept. of Interior (See N71-35702 22-20)
Avail: NTIS HC $6.00/MF $0.95

An improved pulsed laser radar system designed to measure spectroscopically the spatial distribution of atmospheric water vapor is described and some results obtained with this system are presented. The spectroscopic method is applied to the atmosphere via laser radar by utilizing as an energy source the molecular and particulate backscatter which occurs when a pulse of light is projected into the atmosphere. A receiver is located adjacent to the source of the light pulse, and the time history of the detected energy interpreted in terms of the spatial distribution of the water vapor and other attenuating constituents. Author

N71-35719# South Dakota School of Mines and Technology, Rapid City.
[METHODS OF PRECIPITATION MANAGEMENT OF CONVECTIVE CLOUD SYSTEMS IN THE NORTHERN GREAT PLAINS REGION]
In Bur. of Reclamation Proj. Skywater Feb. 1971 p 307-326 refs Supported by Dept. of Interior (See N71-35702 22-20)
Avail: NTIS HC $6.00/MF $0.95

The research to develop methods for beneficially modifying precipitation from convective clouds of the Northern Great Plains Region is reported. Summaries of field experiments are presented, and include: Project Cloud Catcher, Grand River Randomized Project, numerical modeling, and effects of seeding on rainfall. F.O.S.

N71-35720# South Dakota School of Mines and Technology, Rapid City.
[WEATHER MODIFICATION MANAGEMENT IN THE NORTHERN GREAT PLAINS: NORTH DAKOTA PILOT PROJECT]
In Bur. of Reclamation Proj. Skywater Feb. 1971 p 327-345 refs Supported by Dept. of Interior (See N71-35702 22-20)
Avail: NTIS HC $6.00/MF $0.95

The developments in the pilot study for weather modification of the Northern Great Plains are reported. An analysis of the summer field project of 1969 is presented along with the preparations for the 1970 field projects. A summary of the flying and seeding activities for the summer of 1970 is included. F.O.S.

N71-35721# Bureau of Reclamation, Denver, Colo.
[CASCADES ATMOSPHERIC WATER RESOURCES PROGRAM]
In its Proj. Skywater Feb. 1971 p 347-358 Supported by Dept. of Interior (See N71-35702 22-20)
Avail: NTIS HC $6.00/MF $0.95

The mechanisms by which precipitation develops in winter storms over the Cascade Mountains were investigated to determine the feasibility of increasing and redistributing the snowfall by cloud seeding. Topics discussed include: operational procedures, survey of ground measurements, snow particle trajectories, seeding, and computer modeling of orographic precipitation. F.O.S.

N71-35722# Texas A&M Univ., College Station. Dept. of Meteorology
[AIRPLANE AND RADAR INVESTIGATIONS OF CUMULO-FORM CLOUDS IN THE SOUTH CENTRAL UNITED STATES]
In Bur. of Reclamation Proj. Skywater Feb. 1971 p 359-378 Supported by Dept. of Interior (See N71-35702 22-20)
Avail: NTIS HC $6.00/MF $0.95

The dynamic and physical properties of warm cumulus clouds below freezing levels were investigated in southeast Texas to assess the feasibility of warm-cloud management as a water resource. The results of the studies which are summarized include: thermal structure of clear air adjacent to cloud turrets, tests of numerical model, cloud structure, cloud water content, and large drop samples. F.O.S.

N71-35723# Denver Univ., Colo.
CLOUD PHYSICS
In Bur. of Reclamation Proj. Skywater Feb. 1971 p 379-389 Supported by Dept. of Interior (See N71-35702 22-20)
Avail: NTIS HC $6.00/MF $0.95

Ice nuclei generators suitable for cloud seeding use were studied. The types discussed include: AgI, organic vapors, smoke, and metaldehyde powder. The development of a slow activation automatic ice nuclei counter is also discussed. F.O.S.

N71-35724# Denver Univ., Colo.
MODELING
In Bur. of Reclamation Proj. Skywater Feb. 1971 p 391-421 refs Supported by Dept. of Interior (See N71-35702 22-20)
Avail: NTIS HC $6.00/MF $0.95

The work for developing computer programs to be used directly as a real time decision making tool by precipitation management is reported. A list of the computer programs in the Weather Modification Library is given, and the embryonic computer system developed for field use is described. F.O.S.

N71-35725# Montana State Univ., Bozeman. Dept. of Earth Sciences.
[WEATHER MODIFICATION RESEARCH ON FEASIBILITY OF INCREASING HIGH ELEVATION SNOWFALL IN THE NORTHERN ROCKY MOUNTAINS]
In Bur. of Reclamation Proj. Skywater Feb. 1971 p 423-436 refs Sponsored by Bur. of Reclamation (See N71-35702 22-20)
Avail: NTIS HC $6.00/MF $0.95

The research in weather modification to determine the feasibility of increasing high elevation snowfall in the northern Rocky Mountains is reported. Subprojects studied include: airflow and associated diffusion of seeding material over the Bridge Range and target area, use of radar to measure precipitation, temperature and moisture regimes of lower atmosphere, replication and analysis of snow crystals, analysis of

snow samples for silver content, and effectiveness of silver iodide seeding. F.O.S.

N71-35726# Nevada Univ., Reno. Lab. of Atmospheric Physics.
[PRECIPITATION MANAGEMENT AND TECHNIQUES APPLICABLE TO DRAINAGE BASINS CONTRIBUTING WATER TO NEVADA] Annual Report, 1 Jul. 1969 - 30 Jun. 1970
In Bur. of Reclamation Proj. Skywater Feb. 1971 p 437-458 refs Sponsored by Bur. of Reclamation (See N71-35702 22-20)
Avail: NTIS HC $6.00/MF $0.95

The research in atmospheric water resources is reported for developing precipitation management techniques for application to the drainage basins of the Nevada water system. Summaries of work in the following projects are included: instrumentation and data systems, operational adaptation, precipitation, and stream flow analysis. F.O.S.

N71-35727# Wyoming Univ., Laramie. Atmospheric Resources Research Group.
[DEVELOPMENT OF A SOUND SNOWPACK AUGMENTATION SYSTEM WITH SPECIAL EMPHASIS ON OROGRAPHIC CLOUDS] Annual Report, 1 Jul. 1969 - 30 Jun. 1970
In Bur. of Reclamation Proj. Skywater Feb. 1971 p 461-478 refs Sponsored by Bur. of Reclamation (See N71-35702 22-20)
Avail: NTIS HC $6.00/MF $0.95

The numerical simulation of the airflow over Elk Mountain was studied to determine the important cloud physics parameters related to the cap cloud. The cap cloud research is reported in the following areas: environment, airflow, nucleation and particle growth, precipitation, and development of instrumentation. It was found, during seeding experiments, that there is a threshold size of approximately 200 microns below which the crystals do not grow by riming, and contributions by freezing and by deposition are approximately equal. F.O.S.

N71-35728# Utah State Univ., Logan.
[CLOUD SEEDING EXPERIMENTS: WASATCH WEATHER MODIFICATION PROJECT]
In Bur. of Reclamation Proj. Skywater Feb. 1971 p 479-507 refs Supported by Dept. of Interior (See N71-35702 22-20)
Avail: NTIS HC $6.00/MF $0.95

Eighteen airborne and 11 ground-based cloud seeding experiments were conducted during the 1969-70 experimental season. More than 85,000 precipitation measurements were reported. Considerable progress was made in the processing and analyzing of data. Card punching has been essentially eliminated with the development of paper punch tape readout. Programs for processing and plotting the data on a current basis have been prepared. Procedures have been developed for testing the quality of data and for eliminating occasional spurious readings. Individual case studies of precipition patterns and their reaction to meteorological conditions are in progress. The effects of weather modification practices on the volume and distribution of runoff were analyzed from historical streamflow records and watershed simulation techniques. A hydrologic model of the watershed above the gaging station on the Weber River at Oakley was developed and verified. Ensuing runoff resulting from different volumes and geographic distributions of snowpack over the watershed can now be predicted. Author

N71-35729# Western Scientific Services, Inc., Colorado Springs, Colo.
[SURFACE MEASUREMENTS OF METEOROLOGICAL PARAMETERS IN THE UPPER COLORADO RIVER BASIN AND PRELIMINARY DATA ANALYSIS] Progress Report, 1 Jul. 1969 - 30 Jun. 1970
In Bur. of Reclamation Proj. Skywater Feb. 1971 p 509-532 refs Supported by Dept. of Interior (See N71-35702 22-20)
Avail: NTIS HC $6.00/MF $0.95

A summary of the observations during the 1969-70 winter season is presented. The establishment of the surface instrument network, data collection, data reduction, and the telemetry network in the San Juan Mountains are discussed. Charts showing a real distribution of precipitation are included. F.O.S.

N71-35730# Environmental Protection Agency, Washington, D.C.
AIR QUALITY CRITERIA FOR NITROGEN OXIDES
Jan. 1971 119 p refs
(AP-84) Avail: SOD $1.50

The chemical and physical characteristics of nitrogen oxides and the relative merit of various analytical methods for measuring them in the atmosphere are reviewed. Also discussed are the effects of the oxides on visibility, vegetation, and materials; their toxicological effects on animals and man; and epidemiological studies that assess the general population dose response and the specific response of children to nitrogen oxides. Author

N71-35731# Istituto di Fisica Dell Atmosfera, Rome (Italy).
METEOROLOGICAL TRAINING IN ITALY AND THE PROGRAM FOR THE MEDITERRANEAN METEOROLOGY
M. Giorgi Apr. 1970 9 p Presented at the WMO/IAMAP on Higher Education and Training Symp., Rome, 27 Apr. - 2 May 1970
(IFA-RDP-31) Avail: NTIS

An overview of the didactic activity and personnel training in meteorology is presented. The need for training meteorologists at the university and postgraduate level is stressed. The results achieved by the Institute of Atmospheric Physics in collaboration with the Air Force Meteorological Service are considered satisfactory. In addition to developing an Italian National Weather Service, the International Center will assist in satisfying world meteorological requirements, particularly those of the Mediterranean countries. F.O.S.

N71-35732# National Weather Service, Silver Spring, Md.
TORNADO PREPAREDNESS PLANNING
Oct. 1970 32 p
Avail: SOD $0.35

Tornado preparedness planning information is directed primarily to local leaders in the area of the United States most vulnerable to tornadoes and severe thunderstorms, stretching from the Rockies to the Gulf of Mexico and the Atlantic Ocean. Practical suggestions are presented for planning and organizing to minimize tornado and severe thunderstorm losses, commensurate with the frequency of such storms, the density of population, and the resources of communities of various sizes. Author

N71-35733# Danish Meteorological Inst., Charlottenlund.
THE CLIMATE OF DENMARK. 1: WIND, STANDARDNORMALS 1931 - 1960 [DANMARKS KLIMA. 1: VIND, STANDARDNORMALER 1931 - 1960]
Knud Frydendahl 1971 140 p refs In DANISH and ENGLISH
/ts Climatological Papers No. 1
(ISBN-87-7478-002-8) Avail: NTIS

Observations of wind profiles and climatological conditions in Denmark from 1931 to 1960 are presented. Subjects discussed are: (1) frequency of various wind directions by force, (2) most frequent wind force, (3) most frequent wind directions, and (4) seasonal variations in wind force and direction. P.N.F.

N71-35734# Michigan Univ., Ann Arbor. Dept. of Meteorology and Oceanography.
RAIN SCAVENGING STUDIES Progress Report
A. Nelson Dingle Dec. 1970 61 p refs
(Contract AT(11-1)-1407)
(COO-1407-38; PR-7) Avail: NTIS

In 1970 analytical work on samples collected in 1969 was

completed, and some areas of analytical technique for the neutron-activation measurement of indium were worked out, and the procedures published. Field experiments were conducted during the period from May 15 to June 30 in the area of Clinton, Illinois, using the rain-gaging network augmented by samplers to a sampling density of about 1 per 3 sq. mi. Sequential sampling was done at the base station, and, by means of automatic samplers, at three additional stations. Six tracer experiments were conducted and samples were collected from a seventh storm system that passed the area at night. Although analysis has begun, the results of the study are not ready for presentation at this time. Preliminary results for the case of June 1, 1970 are presented. Author (NSA)

N71-35735# Rowland and Co., Haddonfield, N.J.
ANALYSIS OF VFR CLOUD CLEARANCE AND VISIBILITY STANDARDS Final Report
George E. Rowland and Carl T. Reichwein Sep. 1971 120 p refs
(Contract DOT-FA69NA-357)
(FAA-RD-70-48; FAA-NA-71-35) Avail: NTIS

A three-dimensional vector analysis of a two-aircraft near-miss geometry was developed and used to generate a numerical safety rating scheme for quantifying the degree of hazard associated with aircraft-to-cloud separation minimums and with speed-visibility restrictions. Hazard functions were generated for low, medium, and high-speed aircraft. Based upon the resulting data, proposed new Visual Flight Rules were created. The rationale behind the new rules is discussed. Possible effects of the rules are noted. Numerous inadequacies of the data which was inserted in the limited mathematical model are indicated. Additional research needs are sketched. Concern over the broad impact of the proposed new VFR rules, coupled with reservations about the limited scope of the study and the paucity of hard data to incorporate into and actually test out the validity of the model, cause the authors to suggest the firm necessity of substantial additional technical investigation and broad discussion prior to adoption of the new rules. Author

N71-35736# Association Francaise pour l'Etude et le Developpement des Applications de l'Energie Solaire, Paris.
SOLAR RADIATION AND HYDROMETEOROLOGY [RAYONNEMENT SOLAIRE ET HYDROMETEROLOGIE]
22 Oct. 1970 113 p refs In FRENCH Proc. of the meeting of the Sect. Energie Solaire de la Soc. Franc. des Thermiciens, Paris, 22 Oct. 1970
Avail: NTIS

CONTENTS:

1. THEORY OF RADIANT ENERGY BUDGETS: HYDROMETEOROLOGICAL APPLICATIONS C. Perrin de Brichambaut (France. Direc. de la Meteorol. Nationale, Paris) 24 p (See N71-35737 22-20)

2. APPLICATION OF RADIATION MEASUREMENTS TO THE DETERMINATION OF EVAPORATION-PERSPIRATION IN TROPICAL CLIMATE C. Riou (Office de Rech. Sci. et Tech. Outremer, Brazzaville, Congo) 28 p refs (See N71-35738 22-20)

3. ABSORPTION OF RADIANT ENERGY BY VEGETATION: ITS INFLUENCE ON FLUX DENSITY AND APPLICATION TO THE COMPUTATION OF EVAPORATION-PERSPIRATION M. Perrier (Inst. Natl. de la Rech. Agronomique, Paris, France) 30 p (See N71-35739 22-20)

4. ESTIMATE OF RADIANT ENERGY BUDGETS FOR THE COMPUTATION OF NATURAL TEMPERATURE OF A WATER FLOW J. Jacquet and C. Gras (Direc. des Etudes et Rech. d'Elec., Paris, France) 24 p (See N71-35740 22-20)

N71-35737# France. Direction de la Meteorologie Nationale, Paris.
THEORY OF RADIANT ENERGY BUDGETS. HYDROMETEOROLOGICAL APPLICATIONS [ASPECTS THEORIQUES DU BILAN RADIATIF: APPLICATIONS HYDROMETEOROLOGIQUES]
Ch. Perrin de Brichambaut *In* Assoc. Franc. pour l'Etude et le Developp. des Appl. de l'Energie Solaire Solar Radiation and Hydrometeorol. 22 Oct. 1970 24 p In FRENCH (See N71-35736 22-20)
Avail: NTIS

A quantitative study is made of the solar radiation effect on terrestrial evaporation and evaporation-perspiration phenomena in the natural water cycle. The earth atmosphere being considered as a screen, the energy budgets are estimated taking into account the solar and terrestrial radiation. ESRO

N71-35738# Office de Recherche Scientifique et Technique Outremer, Brazzaville (Congo).
APPLICATION OF RADIATION MEASUREMENTS TO THE DETERMINIATION OF EVAPORATION-PERSPIRATION IN TROPICAL CLIMATE [QUELQUES EXEMPLES D'APPLICATIONS DE MESURES DE RAYONNEMENT A LA DETERMINATION DE L'EVAPOTRANSPIRATION EN CLIMAT TROPICAL]
Ch. Riou *In* Assoc. Franc. pour l'Etude et le Develop. des Appl. de l'Energie Solaire Solar radiation and hydrometeorol. 22 Oct. 1970 28 p refs In FRENCH (See N71-35736 22-20)
Avail: NTIS

Radiation measurements performed at meteorological stations in Tchad, Republic of Central Africa, and in Brazzaville, the Congo, are applied to the computation of the evaporation-perspiration in a tropical climate. ESRO

N71-35739# Institut National de la Recherche Agronomique, Paris (France).
ABSORPTION OF RADIANT ENERGY BY VEGETATION: ITS INFLUENCE ON FLUX DENSITY AND APPLICATION TO THE COMPUTATION OF EVAPORATION-PERSPIRATION [ABSORPTION DE L'ENERGIE RADIATIVE PAR UN COUVERT VEGETAL: INFLUENCE DE CELUI-CI SUR L'INTENSITE DES FLUX EN PRESENCE ET APPLICATION AU CALCUL DE L'EVAPOTRANSPIRATION]
M. Perrier *In* Assoc. Franc. pour l'Etude et le Develop. des Appl. de l'Energie Solaire Solar Radiation and Hydrometeorol. 22 Oct. 1970 30 p In FRENCH (See N71-35736 22-20)
Avail: NTIS

The role played by a biological interface (vegetation) on energy distribution, latent heat flux, and evaporation-perspiration of the earth's surface is analyzed. Variables important in evaporation-perspiration phenomena are reviewed, and a mathematical model expressed. ESRO

N71-35740# Direction des Etudes et Recherches d'Electricite, Paris (France).
ESTIMATE OF RADIANT ENERGY BUDGETS FOR THE COMPUTATION OF THE NATURAL TEMPERATURE OF A WATER FLOW [ESTIMATION DES ELEMENTS DU BILAN RADIATIF POUR LE CALCUL DES TEMPERATURES NATURELLES D'UN SECTEUR DE COURS D'EAU]
M. J. Jacquet and M. C. Gras *In* Assoc. Franc. pour l'Etude et le Develop. des Appl. de l'Energie Solaire Solar Radiation and Hydrometeorol. 22 Oct. 1970 24 p In FRENCH (See N71-35736 22-20)
Avail: NTIS

A method for computing the components of radiant energy budgets in a water flow thermal simulation model is described, using data obtained from meteorological ground stations. It is concluded that this method gives a precision of .1 C on the temperatures. ESRO

N71-35741# Institut Royal Meteorologique de Belgique, Brussels.
CLIMATOLOGICAL OBSERVATIONS, MONTHLY BULLETIN, APRIL 1971
1971 15 p In FRENCH and DUTCH
Avail: NTIS

Meteorological parameters observed at different Belgian weather stations during April 1971 are tabulated. ESRO

N71-35742# Meteorologisches Observatorium, Hohenpeissenberg (West Germany).
RESULTS OF THE AEROLOGICAL OZONE SOUNDINGS AND THE TOTAL OZONE MEASUREMENTS DURING THE FIRST HALF OF 1970 [ERGEBNISSE DER AEROLOGISCHEN OZONSONDIERUNGEN UND DER GESAMTOZONMESSUNGEN IM 1. HALBJAHR 1970]
R. Hartmannsgruber, Comp. Feb. 1971 138 p In GERMAN /ts Sonderbeobachtungen des Meteorol. Obs. Hohenpeissenberg Nr. 12
Avail: NTIS

Ozone soundings made from the Hohenpeissenberg Observatory using Brewer-Mast ozonosondes are recorded on tables for the first half of 1970, showing accompanying meteorological parameters. ESRO

N71-35743# Meteorologisches Observatorium, Hohenpeissenberg (West Germany).
RESULTS OF THE AEROLOGICAL OZONE SOUNDINGS AND THE TOTAL OZONE MEASUREMENTS DURING THE SECOND HALF OF 1970 [ERG EBNISSE DER AEROLOGISCHEN OZONSONDIERUNGEN UND DER GESANTOZONMESSUNGEN IM Z. HALBJAHR 1970]
Apr. 1971 187 p In GERMAN /ts Sonderbeobachtungen des Meteorol. Obs. Hohenpeissenberg Nr. 13
Avail: NTIS

Data tables are presented of soundings made from the Hohenpeissenberg Observatory using Brewer-Mast ozonosondes. ESRO

N71-35744# Research Inst. of National Defence, Stockholm (Sweden).
VISIT TO ESRANGE IN CONNECTION WITH THE ROCKET LAUNCHING OF EXPLOSIVE GRENADES, 26 OCTOBER - 1 NOVEMBER 1968 [BESOEK DEN 26.10 - 1.11.1968 VID ESRANGE I SAMBAND MED RAKETUPPSKJUTNING AV SPRAENGGRANATER]
H. Axelsson Feb. 1970 31 p In SWEDISH Original Contains Color Illustrations
(FOA-4-C-4414-26) Avail: NTIS

The launching of 25 explosive grenades by small rockets is discussed. The grenades were designed to detonate at altitudes of 28 to 150 kilometers. Winds and temperatures were determined at the various altitudes following explosion of the grenades. Author

N71-35745# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.
FORT HUACHUCA, ARIZONA. CENTRAL METEOROLOGICAL OBSERVATORY
Oct. 1970 47 p
(AD-726343) Avail: NTIS CSCL 04/2

The report contains tabular data of precipitation, station pressure, temperature, relative humidity, dew point, wind direction and speed, ozone, soil surface temperature, vertical Eppley radiation, net radiation, and total hemispheric radiation at Fort Huachuca, Arizona during October, 1970. GRA

N71-35746# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.
FORT GREELY, ALASKA. CENTRAL METEOROLOGICAL OBSERVATORY
Nov. 1970 72 p
(AD-726338) Avail: NTIS CSCL 04/2

The report contains tabular data concerning precipitation, station pressure, temperature, wind chill wind direction and speed, snow/soil temperature, ozone, and solar radiation at Fort Greely, Alaska during November, 1970. GRA

N71-35747# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.
FORT GREELY, ALASKA. CENTRAL METEOROLOGICAL OBSERVATORY Meteorological Data Report
Oct. 1970 42 p
(AD-726337) Avail: NTIS CSCL 04/2

The report contains the following atmospheric data concerning Fort Greely, Alaska, for the month of October, 1970: Precipitation, station pressure, temperature, relative humidity, wind direction and speed, wind chill, snow/soil surface temperature, delta t, ozone, vertical Eppley radiation, net exchange radiation, total hemispheric radiation, wind roses, hourly averages for the month, monthly climatological summary. GRA

N71-35748# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.
YUMA PROVING GROUND, ARIZONA. CENTRAL METEOROLOGICAL OBSERVATORY
Oct. 1970 74 p
(AD-726358) Avail: NTIS CSCL 04/2

The report contains the following meteorological data for the Yuma Proving Ground during October, 1970: Wind direction and speed, delta T, ozone, precipitation, station pressure, psychrometry (Dry bulb, and wet bulb temperatures, relative humidity, dew point), vertical Eppley radiation, net exchange radiation, total hemispheric radiation, wind roses, hourly averages for the month, monthly climatological summary. GRA

N71-35749# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.
FORT WAINWRIGHT, ALASKA. ALASKA FIELD STATION, FOX LOWER ARCTIC MEDICAL RESEARCH LABORATORY
Nov. 1970 49 p
(AD-726345) Avail: NTIS CSCL 04/2

The report contains meteorological data concerning precipitation, temperature, wind direction and speed, wind roses, hourly averages for the month, and monthly climatological summary for the month of November 1970 at the Alaska Field Station, Fox Lower, and the Arctic Medical Research Laborstory, Alaska. GRA

N71-35750# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.
PANAMA CANAL ZONE, GUNN HILL Meteorological Data Report
Oct. 1970 75 p
(AD-726356) Avail: NTIS CSCL 04/2

The report contains the following meteorological data for Gun Hill, Panama Canal Zone, for October, 1970: precipitation, station pressure, temperature, relative humidity, dew point, wind direction and speed, WBGT (Dry bulb, wet bulb, and black globe temperatures, index), total hemispheric, ozone, wind roses, hourly averages for the month, monthly climatological summary. GRA

N71-35751# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.
PANAMA CANAL ZONE, FORT SHERMAN Meteorological Data Report
Oct. 1970 74 p
(AD-726357) Avail: NTIS CSCL 04/2

The report contains the following meteorological data for Fort Sherman, Panama Canal Zone, for October, 1970: Precipitation, station pressure, psychrometry (dry bulb and wet bulb temperatures, relative humidity, dew point), WBGT(dry bulb, wet bulb, and black globe temperatures), soil surface temperatures, wind direction and speed, ozone, vertical Eppley radiation, net exchange radiation, total hemispheric radiation, wind roses, hourly averages for the month, monthly climatological summary. GRA

N71-35752# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.
FORT WAINWRIGHT, ALASKA, ALASKA FIELD STATION, FOX LOWER, ARCTIC MEDICAL RESEARCH LABORATORY Meteorological Data Report
Dec. 1970 52 p
(AD-726937) Avail: NTIS CSCL 04/2

The report contains the following meteorological data collected at Fort Wainwright during December 1970: atmospheric temperature; atmospheric pressure; humidity; atmospheric precipitation; wind. GRA

N71-35753# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex. Atmospheric Sciences Lab. Meteorological Team.
HUNTER-LIGGETT MILITARY RESERVATION, CALIFORNIA: NACIMIENTO, CENTRAL STONEY, SAN MIGUELITO, HIGH POINT, PALISADES Meteorological Data Report, Nov. 1970
Nov. 1970 103 p
(AD-726939) Avail: NTIS CSCL 04/2

The report contains the following meteorological data collected at sites within the Hunter-Liggett military reservation during November 1970: atmospheric precipitation; atmospheric pressure; atmospheric temperature; humidity; wind. GRA

N71-35754# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.
HUNTER-LIGGETT MILITARY RESERVATION, CALIFORNIA: NACIMIENTO, CENTRAL STONEY, SAN MIGUELITO, HIGH POINT, PALISADES Meteorological Data Report
Dec. 1970 107 p
(AD-726940) Avail: NTIS CSCL 04/2

The report contains the following meteorological data collected at sites within the Hunter-Liggett Military Reservation during December 1970: atmospheric precipitation; atmospheric pressure; atmospheric temperature; humidity; wind. GRA

N71-35755# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.
HUNTER-LIGGETT M. R., CALIFORNIA. MILPITAS, ALPHA, IRUS, JOLON, SAM JONES
Oct. 1970 100 p
(AD-726354) Avail: NTIS CSCL 04/2

The report contains the following meteorological data collected at the Hunter-Liggett Military Reservation sites during October, 1970: precipitation, station pressure, temperature, relative humidity, wind direction and speed, wind rose, hourly averages for the month, monthly climatological summary. GRA

N71-35756# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.
HUNTER-LIGGETT M. R., CALIFORNIA. MILPITAS, ALPHA, IRUS, JOLON, SAM JONES Meteorological Data Report, Nov. 1970
Nov. 1970 102 p
(AD-726355) Avail: NTIS CSCL 04/2

The report contains the following meteorological data collected at sites within the Hunter-Liggett Military Reservation during November, 1970: precipitation; station pressure; temperature; relative humidity; wind direction and speed; wind rose; hourly averages for the month; monthly climatological summary. GRA

N71-35757# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.
HUNTER-LIGGETT MILITARY RESERVATION, CALIFORNIA. AIRFIELD Meteorological Data Report, Nov. 1970
Nov. 1970 74 p
(AD-726347) Avail: NTIS CSCL 04/2

The report contains the following meteorological data for the airfield within the Hunter-Liggett Military Reservation during November, 1970: precipitation; station pressure; psychrometry; net exchange radiation; wind profiles; temperature gradients; wind roses; hourly averages for the month; monthly climatological summary. GRA

N71-35758# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.
HUNTER-LIGGETT M. R., CALIFORNIA. CENTRAL STONEY, NACIMIENTO, SAN MIGUELITO, HIGH POINT, PALISADES Meteorological Data Report, Oct. 1970
Oct. 1970 109 p
(AD-726348) Avail: NTIS CSCL 04/2

The report contains data on precipitation, barometric pressure, temperature, humidity, and wind at selected stations in California for the month of October, 1970. GRA

N71-35759# Dayton Univ., Ohio. Research Inst.
EVALUATION OF THE MAY 1970 HIGH ALTITUDE ROBIN PROGRAM
Nicholas A. Engler Mar. 1971 72 p
(Contract F19628-70-C-0166)
(AD-726824; SR-2; AFCRL-71-0227; SR-2) Avail: NTIS CSCL 04/2

The ROBIN system has a better response to the atmosphere than other sensors. An attempt is made to determine whether or not the response of the sphere to the atmosphere accurately reflects the condition of the atmosphere. An analysis of the May 1970 ROBIN program is made using the data from twenty-seven high altitude passive balloons. Author (GRA)

N71-35760# Air Weather Service, Scott AFB, Ill.
GUIDE TO LOCAL DIFFUSION OF AIR POLLUTANTS
Gordon A. Beals Apr. 1971 90 p refs
(AD-726984; AWS-TR-214) Avail: NTIS CSCL 04/2

The report is intended as a guide on local air pollution for forecasters who have had no prior experience with diffusion. Certain fundamentals of micrometeorology and diffusion in the lower layers are expounded and their relation to the determination of air pollutant dispersion and concentration amounts is explained. Calculations of pollutant concentrations using accepted techniques are systematically discussed and solution of actual air pollution problems are shown in the appendix. Graphs and nomograms used in solving air pollution problems are also furnished in the appendix. Author (GRA)

N71-35761# Air Weather Service, Scott AFB, Ill.
ON THE USE OF RADAR IN IDENTIFYING TORNADOES AND SEVERE THUNDERSTORMS: A DIAGNOSTIC GUIDE FOR RADAR SCOPE INTERPRETATION
Roger C. Whiton May 1971 23 p refs
(AD-726983; AWS-TR-243) Avail: NTIS CSCL 04/2

The report contains material taken from the available literature on identifying severe thunderstorms, hail, and tornadoes from radar echoes. Radar echo signatures indicating severe weather are consolidated for geographical areas and weather types to afford the radar meteorologist easy access to the findings of several investigators in the weather radar field. Information concerning X-band, S-band, and C-band radars is included. Author (GRA)

N71-35762# Arctic Inst. of North America, Washington, D.C.
THE HIGH MOUNTAIN ENVIRONMENT PROJECT ST. ELIAS MOUNTAINS, YUKON AND ALASKA Final Report, 1 Apr. 1967 - 31 May 1971
Melvin G. Marcus (Mich. Univ., Ann Arbor) Jun. 1971 85 p refs
(Contract DAHC04-67-C-0047)
(AD-726405; AINA-RP-61; AROD-8408-B-EN) Avail: NTIS

CSCL 04/2

The results of field investigations conducted in Chilstone Pass in Alaska and on Mt. Logan in Yukon Territory, Canada are presented. A historical and philosophical background of the project is given, as are environmental descriptions of the research areas. During the program, research was carried out in these areas (1) climatology and meteorology, (2) botany and plant geography, (3) periglacial hydrology and geomorphology, and (4) glaciology. Relationships between environmental processes are covered. Abstracts, of published research papers and presentations that derived from the program are included, as is a listing of remaining research reports in progress. Author

N71-35763 National Lending Library for Science and Technology, Boston Spa (England).
MAXIMUM WIND SPEEDS IN THE FEDERAL REPUBLIC OF GERMANY [MAXIMALE WINDGESCHWINDIGKEITEN IN DER BUNDESREPUBLIK DEUTSCHLAND]
W. Caspar 17 Mar. 1971 9 p ref Transl. into ENGLISH from Bantechnik (West Ger.), V. 47, no. 10, 1970 p 335-340
(NLL-Lib-Comm-1590-(5196)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

Wind speed values are listed based on instantaneous gust recording data for West Germany from 1910 to 1968. The absolute maxima wind speeds recorded at 110 locations are given and the frequency with which the daily wind peaks occurred as an annual average is tabulated. Wind loading factors for structural engineering are discussed. J.M.

N71-35764 National Lending Library for Science and Technology, Boston Spa (England).
ON THE POSSIBLE RELATION OF STORMS IN THE SOUTH-WEST PART OF THE KARA SEA TO THE SOLAR ACTIVITY
M. V. Mozalevskaja 2 Mar. 1971 6 p refs Transl. into ENGLISH from Tr. Arkt. Antarkt. Nauch.-Issled. (Leningrad), no. 34, 1970 p 85-89
(NLL-M-20383-(5928.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The possible connection between storms (wind speed of 15 m/sec or greater) in the southwest of the Kara Sea and the 11 year cycle of solar activity is examined. Data from 1939 to 1968 show that there is good agreement between winter storms and solar activity for the years just preceding minimum solar activity (1944, 1954, and 1964). The relationship for the years following minimum activity is not as good, and there is no agreement for summer. The storm data for each year were summed separately for winter and summer for all three cycles, and the stormiest years were found to be those of low solar activity. This agrees with results of a study of the northwestern part of Western Siberia for the five cycles with minima from 1901 to 1944. N.E.N.

N71-35765* + Environmental Data Service, Asheville, N.C. National Climatic Center.
ATLANTIC TROPICAL CYCLONE STRIKE PROBABILITIES (FOR SELECTED STATIONS AND THE MONTH OF SEPTEMBER)
Harold L. Crutcher Aug. 1971 104 p refs
(NASA Order H-76789)
(NASA-CR-81361) Avail: NTIS CSCL 04B

Tropical cyclone strike probabilities for selected stations during the several specified seasons and time intervals are presented. The selected stations are Cape Kennedy, Florida; Mississippi Test Facility, Bay St. Louis, Mississippi; Wallops Island, Virginia; and Houston, Texas. The seasons are June-July, August, September, October, and November-May, and the time intervals are 12-, 24-, 36-, 48-, 72- and 96-hours. In addition, September strike probabilities are shown for 24- and 48-hour time periods for the five-degree latitude-longitude squares in the North Atlantic, Caribbean and Gulf of Mexico. The strike probabilities are given for circles having radii of one, two and three degrees of latitude and centered on either the selected station or the centers of the five-degree latitude-longitude squares. These probabilities are computed from the statistical climatologies of tropical cyclone movements presented by Crutcher (1971). The model employed is the bivariate normal distribution. Author

N71-35766 Freie Univ., Berlin (West Germany). Inst. fuer Meteorologie und Geophysik.
METEOROLOGICAL DATA. VOLUME 115, NO. 6: RESULTS OF THE ASCENTS OF THE RADIOSONDE STATION, BERLIN-TEMPELHOF, OF THE INSTITUT FUER METEOROLOGIE UND GEOPHYSIK OF THE FREIE UNIVERSITAET BERLIN, JUNE 1970. DAILY MEASUREMENTS, MONTHLY COMPILATION AND CLIMATOLOGICAL VALUES AS WELL AS RESULTS OF SPECIAL ASCENTS [METEOROLOGISCHE ABHANDLUNGEN, BAND 115, HEFT 6: ERGEBNISSE DER AUFSTIEGE DER RADIOSONDENSTATION BERLIN-TEMPELHOF DES INSTITUTS FUER METEOROLOGIE UND GEOPHYSIK DER FREIEN UNIVERSITAET BERLIN IM JAHRE 1970, JUNI, TAEGLICHE MESSRESULTATE, MONATLICHE BEARBEITUNG UND KLIMATOLOGISCHE WERTE SOWIE MESSERGEBNISSE VON SPEZIALAUFSTIEGEN]
Eugen Pantzke, Richard Scherhag et al 1970 182 p refs In GERMAN
Avail: Issuing Activity

The detailed results of the radiosonde ascents performed by the aerological station of the Institute for Meteorology and Geophysics of the Free University of Berlin are presented. Cross sections of the averaged temperature and the zonal and meridional wind components in heights above 30 kilometers were constructed. Extreme and mean values of the temperature, pressure, geopotential, wind data, refractivity, pseudopotential temperature, and velocity of sound were extracted for all standard pressure surfaces, several height levels, and the freezing level. Author

N71-35767 Freie Univ., Berlin (West Germany). Inst. fuer Meteorologie und Geophysik.
METEOROLOGICAL DATA. VOLUME 117, NO. 4: DAILY ALTITUDE MAPS OF THE 30 mb LEVEL AS WELL AS MONTHLY MEAN MAPS FOR 1970, PART 4 [METEOROLOGISCHE ABHANDLUNGEN. BAND 117, HEFT 4: TAEGLICHE HOEHENKARTEN DER 30-MB-FLAECHE SOWIE MONATLICHE MITTELKARTEN FUER DAS JAHR 1970]
Krista Hollan, Barbara Krieger, Karin Labitzke, Renate Lenschow, Karin Petzoldt et al 1970 100 p In GERMAN
(GR-4-Pt-4) Avail: Issuing Activity

Daily meteorological charts showing the temperature distribution and variations at the 30 millibar level over earth surface during the last quarter of 1970 are presented. Data tables to substantiate the charts are included. P.N.F.

N71-36171# European Southern Observatory, Santiago (Chile).
METEOROLOGICAL OBSERVATIONS ON LA SILLA IN 1969
B. E. Westerlund *In its* European Southern Obs. Bull. No. 8 Jun. 1971 p 5-20 (See N71-36170 22-30)
Avail: NTIS

21 NAVIGATION

Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications.

N71-35768*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
MATHEMATICAL CONCEPT AND HISTORICAL DEVELOP-

MENT OF THE MASCOT GUIDANCE TECHNIQUE FOR SPACE VEHICLES
C. D. Baker, W. E. Causey, and H. L. Ingram 20 Jul. 1971 244 p refs
(NASA-TM-X-64906) Avail: NTIS CSCL 17G

One guidance concept which permits practical realization of many heretofore unreliable optimal guidance tasks, namely, onboard optimization of ascent trajectories through the atmosphere, self-targeting, optimal rendezvous, optimal coast-burn-coast-burn orbital transfer, and reentry for high lift to drag ratio type of vehicles is described. This collection of techniques combined into one guidance program has been called MASCOT (Manned Shuttle Comprehensive Optimization and Targeting). Author

N71-35769*# TRW Systems, Redondo Beach, Calif.
PPCS ENGINEERING MODEL DESIGN Final Technical Report
R. F. Gates, A. F. Hasck, G. C. Hughes, R. J. Mann, H. S. Tsou et al 7 Jul. 1971 212 p refs
(Contract NAS5-21111)
(NASA-CR-121912; TRW-13900-6011-R0-01) Avail: NTIS CSCL 17G

The precision pointing control system (PPCS) engineering model design is documented. Detailed layouts with specified internal components are developed for electromechanical, electro-optical, and mechanical equipment. Detailed circuit schematics are developed for electronic equipment. This report is designed to be used in conjunction with the final functional design and analysis reports which provide the PPCS system design and related hardware tradeoffs. Author

N71-35770*# Texas Instruments, Inc., Dallas. Equipment Group.
VHF NAVIGATION EXPERIMENT Final Report, Sep. 1968 - Dec. 1970
John F. DuBoes, R. A. Wheeldon, J. L. Costes, C. B. Wason, R. L. Clark et al May 1971 156 p refs
(Contract NAS5-21079)
(NASA-CR-121977; UG-832400-F) Avail: NTIS CSCL 17G

The results of an experiment to determine the accuracy that could be obtained in locating the position of an aircraft when using sidetone ranging signals relayed by two synchronous satellites, ATS-1 and ATS-3 are presented. A real-time display system was developed that allowed the aircraft position, as derived by the satellite system, to be compared with that derived from an airport surveillance radar. It was demonstrated that the use of differential position location techniques could provide location accuracy of 3 nautical miles. Author

N71-35771*# Massachusetts Inst. of Tech., Cambridge. Charles Stark Draper Lab.
KALMAN FILTER INITIALIZATION USING PRIOR INFORMATION APPLIED TO APOLLO MIDCOURSE NAVIGATION
James Merrill Hebbe (M.S. Thesis) May 1971 94 p refs
(Contract NAS5-10386)
(NASA-CR-116153; T-553) Avail: NTIS CSCL 17G

A practical technique of forming a correlated matrix to initiate the filtering process is presented and applied to Apollo navigation during the trans-earth phase of the mission. Results from a digital computer simulation of the midcourse navigation problem utilizing the Monte Carlo approach show that the transient period associated with producing a good estimate is reduced when the correlated matrix, as opposed to a diagonal matrix, is used in initialization. Author

N71-35772*# Massachusetts Inst. of Tech., Cambridge. Charles Stark Draper Lab.
OPTIMAL LATERAL GUIDANCE FOR LOW L/D SHUTTLE VEHICLE ENTRY
John J. Deyst, Donald E. Gustafson, and Bernard A. Kriegsman Jul. 1971 12 p refs Presented at the AIAA Guidance, Control and Flight Mech. Conf., Stony Brook, N. Y., Aug. 1971
(Contract NAS9-10268; DSR Proj. 55-40900)
(NASA-CR-116146; E-2592) Avail: NTIS CSCL 17G

A technique is presented for the design of switching thresholds for use in the lateral guidance of an entry vehicle. Lateral maneuvers are accomplished by roll modulation about the relative-velocity vector. The problem is formulated as an optimal stochastic control problem, using the projected lateral miss and the direction of roll as state variables. Two different cost functions are used to implement the tradeoff between miss-distance and roll maneuvers: the expected value of the weighted sum of the number of rolls and the square of the miss-distance, and the probability that the miss exceeds a preselected threshold with the maximum number of roll maneuvers specified a priori. In the cases studied, satisfactory terminal accuracies were obtained with as few as three roll reversals over a typical entry trajectory. Author

N71-35773*# National Aviation Facilities Experimental Center, Atlantic City, N.J.
MINIMIZE SNOW AND WEATHER EFFECTS-VORTAC TASK 2 TACAN ANTENNA Interim Report, May 1968 - Aug. 1971
G. J. Hertrenft Sep. 1971 24 p ref
(FAA-RD-71-56; FAA-NA-71-4) Avail: NTIS

The various techniques used to minimize the effects of snow and ice on the RTA-2 TACAN antenna are discussed. The techniques were: (1) a wire-wrapped radome with current flowing through the wires attached to the external surface of the radome; (2) enlarge radomes; (3) coating existing radome with hydrophobic materials; and (4) providing a polyurethane shroud over the existing radome with movement of the shroud provided by antenna vibration, wind, or air inflation. The polyurethane shroud showed the most promise of all the techniques tested. Author

N71-35774*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
IRRADIATION EFFECTS ON MANUAL SIGHTING ACCURACY OF A SPACE FLIGHT RATED SEXTANT USING SIMULATED LUNAR AND STELLAR TARGETS
Frederick W. Boltz and Richard F. Haines Washington Sep. 1971 26 p refs
(NASA-TN-D-6507; A-3883) Avail: NTIS CSCL 17G

The simulated sighting targets consisted of a + 2 (visual) magnitude star and a simulated moon (approx 1/2 deg diam). Four values of lunar disk luminance were used with four sighting configurations (star on near lunar limb, star on far lunar limb, upper lunar limb on lower lunar limb and lower lunar limb on upper lunar limb). Four experienced subjects obtained 1920 sextant observations. The spaceflight-rated sextant was a handheld type instrument with an 8-power telescope. It was mounted in a gimbal support to eliminate sighting errors due to variable angle and parallax effects when uncollimated targets are viewed at short range. The results indicate essentially no irradiation-related error when limb on limb is viewed (e.g., when the subtense angle of an illuminated body such as the moon is measured with the sextant). In contrast, the star-on-lunar-limb results show an appreciable irradiation effect amounting to about 15 arc sec on the average at the higher levels of lunar disk luminance. The limb-on-limb sightings were repeatable with greater precision than the star-on-limb sightings. These data are related to a physiological optical model that suggests the primary cause of the irradiation-induced angular sighting error was not within the sextant but within the eye of the observer and was due to retinal sensitivity reductions caused by ectoptic sextar. Author

N71-35775*# Intermetrics, Inc., Cambridge, Mass.
SPACE SHUTTLE LANDING NAVIGATION USING PRECISION DISTANCE MEASURING EQUIPMENT Final Report

William S. Widnall and H. Raymond Morth 2 Aug. 1971 186 p refs
(Contract NAS9-11593)
(NASA-CR-115138) Avail: NTIS CSCL 17G

A study was conducted to determine if precision distance measuring equipment (DME), aiding the inertial navigation, can be used to meet the space shuttle landing navigation accuracy requirements. The investigation revealed: (1) The same precision DME that is utilized for navigation in other mission phases is all that is required to meet the very stringent shuttle landing navigation accuracy specification. (2) An independent source of altitude data is not required. (3) The onboard equations for landing navigation demonstrated satisfactory performance. (4) The minimum number of working transponders necessary to guarantee satisfactory landing navigation performance is three. (5) Satisfactory performance of the Kalman filter was demonstrated by a five-landing Monte Carlo simulation. (6) Initialization of the landing navigation after a normal deorbit and entry can be delayed safely until the shuttle is within 150 km of the airport. D.L.G.

N71-35776*# Cubic Corp., San Diego, Calif.
CR-100 IMPLEMENTATION STUDY FOR SPACE SHUTTLE Final Technical Report
24 Jun. 1971 103 p refs Prepared for Intermetrics, Inc.
(Contract NAS9-11593)
(NASA-CR-115147; FTR/16-1) Avail: NTIS CSCL 17G

The performance of the basic CR-100-1 CIRIS designed equipment were examined with respect to the space shuttle requirements to define the product improvements needed to upgrade the equipment to the space shuttle requirements. The CR-100 CIRIS is a radio reference subsystem (RRS) for use with an inertial measurement unit (IMU) in a completely integrated range instrumentation system (CIRIS). The subsystem consists of an airborne interrogator unit operating under the control of the IMU computer, and one or more ground-based transponders installed at known (surveyed) locations. The RRS design provides a capability for (1) selecting a transponder for interrogation as commanded by the IMU computer, using a digital data link over distances up to 200 miles; (2) measuring the slant range to the transponder with instrumental accuracies to within 3 feet rms, and (3) measuring the range rate of the aircraft with respect to the selected ground station with accuracies to within 0.06 feet per second rms. These accuracies have been demonstrated by actual testing. The IMU computer employs the RRS data to update its own position parameters and thus continually correct for drift. The CR-100-1 CIRIS with minor modifications can meet the performance goal for the Model CR-100-4 which is to provide accurate range and velocity information during all phases of space shuttle operations including secant tracking, orbital navigation update, orbital rendezvous, re-entry navigation update, terminal approach and landing. Author

N71-35777# Airborne Instruments Lab., Deer Park, N.Y.
DEVELOPMENT PROGRAM ADVANCED INTEGRATED LANDING SYSTEM (AILS)
John L. O'Connor Sep. 1971 180 p
(Contract DOT-FAWA-4616)
Avail: NTIS

The design, development, and field and flight tests of an all-weather landing system developed for the FAA are described. This system, which uses scanning microwave antennas, provides precision azimuth, elevation, and range guidance information to equipped aircraft, and also provides aircraft space position information to a ground monitor radar console. Basic design information is provided on the system and the various units that make up the system. A description of the delivered equipment is also presented. Various tests that were conducted with the equipment, in order to indicate conformity with the contract specification, are also described. Although limited in scope, the tests indicated performance better than specified, with one-sigma standard deviations of 0.028 degree in elevation angle, 0.021 degree in azimuth angle, and 75 feet in range. It is concluded that the objectives of the development and test program to provide highly accurate space position data for guidance and control of approaching and landing aircraft to touchdown were met. Author

N71-35778# Research Inst. of National Defence, Stockholm (Sweden).
NAVIGATION ESTABLISHMENTS IN NORWAY: A STUDY VISIT, JUNE 1969 [NAVIGERINGSANLAEGGNINGAR I NORGE: STUDIEBESOEK, JUNI 1969]
Sylve Arnzen, Torsten Linell, Robert Parmhed, and Torgny Rustan Nov. 1969 30 p In SWEDISH
(FOA-3-C-3613-65) Avail: NTIS

The application of Norwegian experience with Omega navigation to the installation of the same system in Sweden is discussed. The operation of Loran A, Loran C, Decca, and Consol navigation systems is discussed. Author

N71-35779# National Aviation Facilities Experimental Center, Atlantic City, N.J.
TASK 1, TEST AND EVALUATION OF SOLID STATE 100 WATT VOR TRANSMITTING EQUIPMENT Final Report Mar. 1969 - Aug. 1971
Barry S. Brayer Sep. 1971 38 p
(FAA-RD-71-65; FAA-NA-71-13) Avail: NTIS

The development and testing of a 100-watt solid state VHF omnirange (VOR) transmitter are discussed. The VOR provides azimuth guidance to enroute aircraft in the national airspace system. The transmitting system tested is used to generate signals. Results of the tests provide data for establishing specifications for the next generation of VOR transmitting equipment. Author

N71-35780# North American Rockwell Corp., Columbus, Ohio.
STRAPDOWN LASER-SEEKER GUIDANCE SIMULATION Final Report
R. E. Gallagher and R. D. Ehrich Jun. 1971 199 p
(Contract DAAH01-70-C-1356)
(AD-726376; Nr71H-111) Avail: NTIS CSCL 17/7

The report presents the detailed analysis and simulation evaluation of the Dynamic Lead Guidance concept and an alternate navigation concept. Effects of several strapdown laser seeker parameters on final miss distance are presented. Author (GRA)

N71-35781# Army Mobility Equipment Research and Development Center, Fort Belvoir, Va. Materials Research Support Div.
TEST AND EVALUATION OF LENSATIC COMPASSES MODIFIED WITH TRITIUM-SEALED SOURCES
Robert C. McMillan and Judson M. Thurston Feb. 1971 25 p refs
(AD-726362; USAMERDC-1997) Avail: NTIS CSCL 17/7

The Army's lensatic compass has been modified with sealed luminous sources of tritium gas. These sources provide more luminosity with fewer radiological hazards. The results from mechanical and radiological tests are reported. The sealed sources introduced no mechanical problem and virtually eliminated the escape of tritium from the compass. The hazards associated with the accidental release in storage locations are evaluated. Author (GRA)

N71-35782# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
AIR NAVIGATION, CHAPTER 7
V. I. Osadshii et al 9 Feb. 1971 35 p Transl. into ENGLISH from the book "Vozdushnaya Navigatsiya" Moscow, Izd-Vo transport, 1969 p 228-249
(AD-726603; FTD-MT-24-340-70) Avail: NTIS CSCL 17/7

The methods of automatic coordinate reckoning continue to be improved on the basis of the success of aviation automation using analog and digital resolving devices having various

electronic (including micromodular) elements and units. There are numerous versions of instruments which perform the automatic computation of current MS coordinates. They receive from organizations-manufacturers in various designations: ground-position indicators, navigation indicators, navigation computers, automatic navigation devices, svigraphs, navigation independent system, and others. The questions of navigational use of only the geotechnic coordinate computers are considered which completely pertain to the use of more recent computers during their work in emergency conditions of the independent navigation system NAS-1. Author (GRA)

N71-35783# Air Force\Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PRINCIPLES OF DESIGN AND CALCULATION OF GYROSCOPIC DEVICES, CHAPTERS 4-10
V. A. Pavlov 29 Apr. 1971 444 p refs Transl. into ENGLISH from the book "Osnovy Rasktirovaniya i Raschets Giroskopicheskikh priborov" Leningrad, Izd-vo Sudostroyeniya, 1967 p 100-404
(AD-726576; FTD-MT-24-263-70) Avail: NTIS CSCL 17/7

The book deals with methods for determination of basic parameters of gyroscopic devices in relation to their purpose. The book was written for college students specializing in the field of gyroscope construction. It represents a manual for course and diploma projects, therefore it can be useful to post-graduate students working on improvement of precision of gyroscopic devices and systems. Author (GRA)

N71-35784# University of Southern Calif., Los Angeles.
STUDIES IN AEROSPACE VEHICLE DETECTION AND DEFENSE Final Report
Nasser E. Nahi, George A. Napjus, John C. Diebel, and C. A. Cooper 28 Jun. 1971 209 p refs
(Contract F33615-70-C-1398)
(AD-727060; AFAL-TR-71-162) Avail: NTIS CSCL 12/1

The report describes the investigation and development of new concepts and techniques in the areas of control systems, optimal tracking, and signal processing, particularly as they apply to navigation and guidance of space vehicles. Four separate problems have been explored. The first problem concerns the design of optimal trajectories for parameter estimation. Particular emphasis is placed on the optimal utilization of a priori information and on problems involving multiple parameters. The second problem concerns the estimation of signal to noise ratio in communication systems. Implementation of both maximum likelihood and least squares estimators is discussed and the results of a simulation of a simple SNR measurement device are described. The third problem describes the design of a generalized feedback controller which, in addition to determining the optimal control strategy, determines the optimal number and scheduling of observations. The fourth problem concerns the optimal filtering of tracking observations under conditions in which spurious measurements may be present. Author (GRA)

N71-36220# Czechoslovak Academy of Sciences, Prague.
DIRECT DETERMINATION OF DIRECTION COSINES OF LINE CONNECTING TWO STATIONS FROM NONSIMULTANEOUS OBSERVATIONS OF THE ARTIFICIAL EARTH SATELLITES
J. Vondrak *In* Polish Acad. of Sci. Observations of Artificial Earth Satellites, no. 9, 1969 1970 p 137-143 (See N71-36206 22-31)
Avail: NTIS

N71-36221# Academy of Sciences (USSR), Moscow.
ACCURACY OF DETERMINING THE POSITION OF THE GEOS-B SATELLITE IN SPACE ACCORDING TO SYNCHRONOUS RIGA-UZHGOROD OBSERVATIONS
A. G. Kirichenko *In* Polish Acad. of Sci. Observations of Artificial Earth Satellites, no. 9, 1969 1970 p 145-149 refs In RUSSIAN; ENGLISH summary (See N71-36206 22-31)
Avail: NTIS

N71-36222# Polish Academy of Sciences, Warsaw.
APPLICATION OF THE LEAST SQUARES METHOD GENERALIZED TO A DEPENDENT OBSERVATION FOR SPACE TRIANGULATION COMPENSATION
V. Seran *In its* Observations of Artificial Earth Satellites, no. 9, 1969 1970 p 151-160 refs In RUSSIAN; ENGLISH summary (See N71-36206 22-31)
Avail: NTIS

22 NUCLEAR ENGINEERING

Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems, and 28 Propulsion Systems.

N71-35786*# Thermo Electron Corp., Waltham, Mass.
DESIGN STUDY OF A HIGH FUEL FRACTION, EXTERNALLY-FUELED THERMIONIC DIODE SUITABLE FOR IN-PILE TESTING Final Report
Donald M. Ernst May 1971 98 p refs Prepared for JPL
(Contracts NAS7-100; JPL-952469)
(NASA-CR-121919; TE-5107-145-71) Avail: NTIS CSCL 18K

Results of the design study, including the critical component investigations are summarized in detail. The preliminary design study showed, by thermal stress analysis, that with all other conditions equal, the stress considerations favor the unbonded emitter-fuel structure concept: there is no permanent deformation of any of the components of the unbonded emitter-fuel structure, and the residual stress at room temperature after numerous thermal cycles is reduced to a minimum. However, since the all-bonded emitter-fuel structure has not only the advantage of lower ohmic losses, but also the capability of being tested with fuel in place, and since it has fewer components and is a two-material (rather than a four-material) system, three representative sample all-bonded emitter-fuel structures were fabricated and tested to investigate their structural integrity experimentally. Preliminary test results indicate that an all vapor deposited fluoride tungsten, all-bonded structure appears to be satisfactory from fabrication and operational points of view. Author

N71-36788# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Obninsk (USSR). Fiziko-Energeticheskii Inst.
STUDIES OF PHYSICAL CHARACTERISTICS OF THE CRITICAL ASSEMBLY MOCKUP FOR THE BOR-REACTOR
A. A. Shyskalka, V. V. Bondarenko, A. I. Vorapaev et al 1970 44 p refs In RUSSIAN
(FEI-201) Avail: AEC Depository Libraries

Testing of critical assembly models for a fast experimental reactor was done to determine the accuracy of predicting critical mass, efficiency of element control, and sodium void reactivity effect. Studies were also conducted on changes in various spectral characteristics, the major reactivity coefficients for different materials, and the distributions of certain reactions. The compact assembly, the first model variant, was used to verify the accuracy of critical mass calculation, to study the efficiency of different materials in the center and other parts of the reactor, and to measure the relationship of the center cross section to the distribution of U-235 and U-238 fission. The remaining variants permitted calculation of loss in reactivity during withdrawal of the fuel rods and their substitution in the model of the control and safety rod elements in insert and extract positions. Measurements indicate a possibility for using tantalum rods as an automatic regulator for the reactor, with acceptable efficiency. Calculation of the significance of neutron spectra and current distributions of different energy groups were made on the basis of diffusion theory. Transl. by K.P.D.

N71-35787*# Scripta Technica, Inc., Washington, D.C.
BRIEF DESCRIPTION OF THE PILOT PLANT INSTALLATION AND THE INCORE-THERMIONIC REACTOR [KURZE BESCHREIBUNG DER VERSUCHSANLAGE UND DES INCORE THERMIONIK-REAKTORS]
NASA Aug. 1971 40 p Transl. into ENGLISH from Incore-Thermionik-Reaktor, Dec. 1970 35 p
(Contract NASw-2036)
(NASA-TT-F-13744) Avail: NTIS CSCL 18E

The high electrical power density of the thermionic converter, the installation of this energy converter in the core of a reactor, and the liquid metal cooling yields a very compact arrangement for a small power plant. The static operating mode and the property of converting thermal energy at a high temperature into electrical energy, with adequate thermal efficiency, are described. The proposed experimental reactor is a prototype for use in spaceflight. The waste heat is led out of the core at high temperature and the experimental installation is also conceptually oriented toward testing under the environmental conditions of space. These environmental conditions are produced by a vacuum system, which allows simulating the thermal radiation from the reactor tank and reflector surface in space. Author

N71-35788# Japan Atomic Energy Research Inst., Tokyo.
ON THE COLUMNAR GRAIN GROWTH IN THE CENTER LINE HEATED UO2 PELLET
Michio Ichikawa and Masaaki Uchida Dec. 1970 23 p refs In JAPANESE; ENGLISH summary
(JAERI-Memo-4249) Avail: AEC Depository Libraries

Columnar grains grow in sintered UO2 pellets when heated under a temperature gradient at high temperature. The mechanism of columnar grain growth is believed to be attributed to the migration of lenticular voids up to the central high temperature region. A study was conducted using 95% theoretical density UO2 pellets, where the heating power and the heating time were taken as parameters, in which it was found that the columnar grain was formed without any trace of lenticular voids. Based on results obtained mainly by ceramography and micro X-ray diffraction, it is concluded that the columnar grain could be formed by the grain growth under a temperature gradient. The driving force for the columnar grain growth was considered to be the thermal stress as well as the decrease in the grain boundary energy. NSA

N71-35789# Japan Atomic Energy Research Inst., Tokai. Tokai Research Establishment.
PHASE STUDY OF THE SYSTEM UO2-Dy2O3
Masaaki Uchida and Michio Ichikawa Jul. 1970 10 p refs
(JAERI-1203) Avail: AEC Depository Libraries

The pseudo-binary system UO2-Dy2O3 was prepared by heat-treatment in a helium atmosphere at 1100 to 2100 c, and studied by means of X-ray diffraction and metallography. A fluorite-structure solid solution was formed up to DyO1.5 content of 55 to 65 mole %, depending on the temperature. An intermediate phase with bcc structure, different from the so-called C-form Dy03, was observed, extending to the more uranium-rich region at higher temperature. This phase is considered to be an ordered structure of the fluorite-type solid solution, accompanied by a change of the O/M ratio. Between this and the C-form Dy2O3 phase, there exists a broad two-phase region, extending from about 70 to 90 mole % of DyO1.5, depending on the temperature. Author (NSA)

N71-35790# Central Electricity Generating Board, Berkeley (England). Nuclear Labs.
CODE OF DESIGN FOR RESEARCH APPARATUS CONTAINING MOLTEN SODIUM
V. J. Stewart Oct. 1970 28 p refs
(RD-B-M-1817) Avail: AEC Depository Libraries

This code gives guidance to design engineers on good practice in the design of molten sodium systems and deals specifically with sodium containment, demountable joints, cover gas systems, pressure relief, and other important auxiliaries. There is also a section on heat transfer which includes useful heat transfer correlations. Appendices deal in more detail with thermal stress estimation and a calculation useful in the design of cold traps. Author (NSA)

N71-35791# Atomic Energy Establishment, Winfrith (England). Control and Instrumentation Div.
PARAMETER FITTINGS OF A NUCLEAR REACTOR MATHEMATICAL MODEL IN THE FREQUENCY DOMAIN WITH ALTERNATIVE FORMS OF WEIGHTING FUNCTION
J. D. Cummins Apr. 1971 12 p refs
(AEEW-M-1012) Avail: AEC Depository Libraries; HMSO: 7 1/2 p; BIS $0.25

One aspect of the matching of mathematical models to experimental responses is considered. The integral least squares difference between open loop experimental and model frequency responses is modified by a weighting function, so as to emphasize in the model matching the part of the experimental open loop frequency response in the region of the (-1,0) point on the Nyquist diagram. The intuitive idea behind this form of weighting function is to obtain a mathematical model which is equivalent to the industrial plant, at least as far as stability in the linear sense is concerned, and also a model which will respond in a similar manner to demand changes and disturbances when the control loop is closed. Author (NSA)

N71-35792# Atomic Energy Commission Research Establishmen, Lucas Heights (Australia).
CHANGE IN THE THERMAL CONDUCTIVITY IN AN OXIDE FUEL DURING BURNUP
H. Kleykamp Feb. 1971 10 p refs Transl. into ENGLISH from West German report KFK-1245
(LIB/Trans-348; KFK-1245) Avail: AEC Depository Libraries

The influence of the porosity and change in stoichiometry as well as the heat transfer coefficient was estimated. The formation of the fission products during burnup led to a decrease in thermal conductivity. The latter fell by 25% after a burnup of 10% due to the solid solution formation (U,Pu) oxide-rare earth oxides-zirconia. An increase of about 8% compared with the pure matrix is to be expected in the case of metallic and oxide inclusions in dispersion form. Author (NSA)

N71-35793*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A MINI-CAVITY PROBE REACTOR
Robert E. Hyland 1971 11 p refs Proposed for presentation at Uranium Plasma Conf., Atlanta, 15-17 Nov. 1971; Sponsored by AIAA
(NASA-TM-X-67928; E-6593) Avail: NTIS CSCL 21F

The mini-cavity reactor rocket engine concept is discussed which combines the high specific impulse from a central gaseous fueled cavity (0.6 m diam) and NERVA type fuel elements in a driver region that is external to a moderator-reflector zone to produce a compact light weight reactor. The overall dimension including a pressure vessel that is located outside of the spherical reactor is approximately 1.21 m in diameter. Specific impulses up to 2000 sec are obtainable for 220 to 890 N of thrust with pressures less than 1000 atm. Powerplant weights including a radiator for disposing of the power in the driver region are between 4600 and 32,000 Kg, less than payloads of the shuttle. The reactor could also be used as a test reactor for gas-core, MHD, breeding and materials research. Author

N71-35794*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF BUOYANCY ON FUEL CONTAINMENT IN AN OPEN-CYCLE GAS-CORE NUCLEAR ROCKET ENGINE
Henry A. Putre [1971] 13 p refs Presented at 2d Symp. on Uranium Plasma, Atlanta, 15-19 Nov. 1971; Sponsored by AIAA
(NASA-TM-X-67924) Avail: NTIS CSCL 21F

Scaling laws for the buoyancy effect on fuel containment in

an open-cycle gas-core nuclear rocket engine are determined so that experimental conditions can be related to the engine conditions. The fuel volume fraction (proportional to the contained fuel mass) in a short coaxial flow cavity is calculated with a programmed numerical solution of the steady Navier-Stokes equations for isothermal, variable density fluid mixing. The solution includes buoyancy, pressure gradient, and viscous shear terms, as well as the effects of side and end walls. Solutions are obtained at a propellant-to-fuel flow ratio of 50 and a Reynolds number of 1000, for fuel-to-propellant density ratios ranging from 1.0 to 10, and for various vehicle accelerations. The main limitation of the analysis is that the numerical solution fails to converge for Reynolds numbers above about 1000. Author

N71-35795*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
NOZZLE AND CAVITY WALL COOLING LIMITATIONS ON SPECIFIC IMPULSE OF A GAS-CORE NUCLEAR ROCKET
Albert F. Kascak [1971] 10 p refs Presented at 2d Symp. on Uranium Plasma, Atlanta, 15-17 Nov. 1971; Sponsored by AIAA
(NASA-TM-X-67923) Avail: NTIS CSCL 21F

It is shown that for an eight foot cavity diameter uranium plasma nuclear rocket operating at a pressure of 1000 atm and a propellant mass flow rate of 10 lbm/s, the cavity wall could be cooled up to a power level of 7400 MW. This corresponds to a maximum cavity specific impulse of 5800 s. The wall heat flux was very low for any reactor power below this limit of 7400 MW. There was a relatively cool, opaque insulating layer of seeded propellant between the hot plasma and the solid wall. The degradation effect of the transpirationally cooled nozzle on the cavity specific impulse resulted in a maximum specific impulse of 5200 seconds at a reactor power of 7400 MW. Approximately 12 percent of the total propellant was used to cool the nozzle wall. Author

N71-35796*# General Electric Co., Cincinnati, Ohio. Nuclear Systems Programs.
SNAP-8 REFRACTORY BOILER DEVELOPMENT PROGRAM: ANALYSIS AND TESTING OF A SINGLE TUBE MERCURY BOILER Topical Report No. 7
Edward S. Hsia Sep. 1971 283 p refs
(Contract NAS3-10610)
(NASA-CR-72897; GESP-650) Avail: NTIS CSCL 18N

The results of an experimental investigation of heat transfer and fluid flow during forced convection boiling of wetted mercury in a single tantalum tube with composite vortex generator insert are presented. The experiments were conducted with a NaK-heated and highly-instrumented test section at mercury saturation temperature up to 1130 F. Exploratory local two-phase forced convection boiling results for mercury are presented for nucleate boiling, the critical heat flux condition, transition boiling and superheated vapor regions in a once-through boiling process. The experimental data and the associated correlations are directly applicable for the design and optimization of once-through boilers for Space Power Rankine Cycle Systems employing mercury as the working fluid. Author

N71-35797# Central Electricity Generating Board, Berkeley (England). Nuclear Labs.
OBSERVATIONS DEMONSTRATING THE RE-SOLUTION OF GAS FROM BUBBLES AND SINTERING PORES DURING THE IRRADIATION OF UO2 AT A HIGH TEMPERATURE
J. A. Turnbull and R. M. Cornell Jun. 1970 9 p refs
(RD/B/N-1716) Avail: AEC Depository Libraries

Samples of UO2 were irradiated to a total dose of 5 times 10 to the 23rd power thermal neutrons m squared at a constant temperature of 1200 C. Examination by scanning electron microscopy before and after irradiations shows the removal of all but the largest sintering pores. Transmission electron microscopy of preirradiated and annealed material shows a drastic alteration in the intragranular fission gas bubbles by the above irradiation. Both observations confirm the existence of an efficient re-solution process at power reactor operating temperatures. Author (NSA)

N71-35798# Central Electricity Generating Board, Berkeley (England). Nuclear Labs.
STRESS INTENSITY FACTORS FOR CURVED NOTCHES IN LONGITUDINAL SHEAR
M. O. Tucker Nov. 1970 24 p refs Submitted for publication
(RD/B/N-1838; RPC(GP)/P-(70)34) Avail: AEC Depository Libraries

Closed expressions are presented for Mode 3 stress intensity factors for isotropic elastic half-spaces containing certain curvilinear notches and surface features. The results may be applied to the fracture strength of HTR fuel compacts. NSA

N71-35799# Atomic Energy Establishment, Cairo (Egypt). Reactors Dept.
EFFECT OF DIFFERENT REFLECTORS ON UA-RR-1 REACTOR CORE CHARACTERISTICS
Sh. Abd-El-Semie and G. Karcheva 1969 54 p refs
(UARAEE-73) Avail: AEC Depository Libraries

The effect of different reflectors on the main core characteristics of the UA-RR-1 reactor (water-type research with enriched fuel) is studied. The one and two-layer reflectors are considered. Ordinary water, heavy water, graphite and beryllium are investigated as a reflector materials. The problem is solved in the two-group diffusion approximation by an IBM-1620 computer; the computer codes are given. The results obtained can be utilized in early stages of reactor design. Author (NSA)

N71-35800# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
ANALOG STUDY OF PROPULSION POWER REACTORS [ETUDES ANALOGIQUES D'UNE CHAUFFERIE NUCLEAIRE DE PROPULSION]
J. Boulven 12 Feb. 1971 35 p In FRENCH Presented at Meeting on Nucl. Reactors for Marine Propulsion, Maiskoff, France, 17 Feb. 1971
(CEA-CONF-1750; Conf-710214-1; Rept-2288/SER/520) Avail: AEC Depository Libraries

The analog and hybrid computer laboratory of Saclay has extensively studied ship propulsion reactors. The scheme of the physical model retained for the simulation (the core and the thermal circuits of the reactor constitute the principal parts), the physical equations, the analog study, and the program are presented. In spite of the large number of analog elements envisaged, resolution does not present any difficulties. An accuracy of about 1% was achieved. NSA

N71-35801# Battelle-Northwest, Richland, Wash.
ZODIAC-G: A CODE FOR MULTIGROUP, MULTIREGION BURNUP CALCULATIONS
R. H. Holeman and D. D. Matsumoto May 1971 108 p refs
(Contract AT(45-1)-1830)
(BNWL-1559) Avail: NTIS

The ZODIAC-G computer code is designed to do one-dimensional, multigroup, multiregion burnup analysis of nuclear reactor fuel. The code is written for use on the UNIVAC 1108 computer. The ZODIAC-G includes the reactor physics codes HRG, THERMOS, HFN, CLERKC, and ALCHEMY which are chained together for efficient use. The ZODIAC-G is extremely flexible, thus it requires more input data than some other burnup codes. Microscopic cross sections can be recalculated whenever desired during a burnup calculation. Nonburnup problems can be run very easily by using component codes of ZODIAC-G. Author (NSA)

N71-35802# Atomic Energy Commission, Oak Ridge, Tenn.
NUCLEAR REACTORS FOR SPACE POWER
William R. Corliss 1971 49 p refs Revised

Avail: NTIS; USAEC, P. O. Box 62, Oak Ridge, Tenn. 37830

The principles of nuclear-reactor space power plants are described and compared with chemical fuels, solar cells, and systems using energy from radioisotopes. Nuclear reactor applications in space exploration and utilization are discussed. J.M.

N71-35803# Atomic Energy Commission, Oak Ridge, Tenn. Div. of Technical Information.

BREEDER REACTORS

Walter Mitchell, III and Stanley E. Turner 1971 49 p

Avail: NTIS

Breeder reactor research, types of breeders, and the future of the program are described in this booklet provided by the United States Atomic Energy Commission. It is one of a series of nontechnical publications devoted to increasing public awareness and understanding of developments in nuclear research. J.G.M.

N71-35804# Pennsylvania State Univ., University Park. Dept. of Nuclear Engineering.

NEW SAFETY SYSTEM DESIGN FOR NUCLEAR POWER REACTORS

A. H. Geesey, Jr. and M. A. Schultz Jul. 1971 56 p refs

(B-103) Avail: NTIS; Eng. Publ., Hammond Building, Pa. State Univ., University Park 16802: $2.00

A new reactor protection system was devised that promises increases in reliability of 200 or more over conventional systems. Four principal techniques are combined to obtain this improvement. The first is multiplexing, whereby individual channels are coupled together by voters so that if any channel path is interrupted the safety signal can still get through. The second involves fusing, so located that potentially dangerous short circuits are converted into harmless open circuits. The third technique provides an automatic logic shift from 2 out of 4 to 2 out of 3 whenever a component fails. With this logic shift, two failures of any kind can occur simultaneously without affecting the safety of the system. Finally, computer testing reduces the mean time to repair. The computer scans strategic circuits several times a second, locating faults almost instantaneously. The computer is decoupled from the system by optical paths, and a computer failure can affect only the logic shift. Author

N71-35805# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Angewandte Reaktorphysik.

STRUCTURE AND WORKING OF THE ON-LINE SYSTEM FOR SNEAK DATA PROCESSING AND CONTROL OF EXPERIMENTS

P. van Velze et al May 1970 62 p refs Transl. into ENGLISH from German report KFK-1188 Sponsored by USAEC-EURATOM (EURFNR-803) Avail: NTIS

On-line computer application in the field of nuclear reactor experiments is discussed. A technical description of the installation for computerized data acquisition and experiment control at the fast zero power reactor SNEAK is given. Typical applications are the calibration of the reactor control rods, material worth measurements, axial and radial fission rate traverses, neutron spectroscopy, and automatic tests of experimental equipments. The on-line system has been found to be more reliable than the method based upon data acquisition with punched paper tapes and off-line reduction of experimental data. Previously, for example, it took up to 4 days to obtain a control rod calibration curve. Now it is plotted immediately after the calibration procedure. For certain experiments the manual control of the system has been greatly simplified. Author (NSA)

N71-35806# Kernforschungszentrum, Karlsruhe (West Germany).

INHERENT STABILITY OF THE STEAM-COOLED BREEDER

W. Frisch et al Mar. 1969 26 p refs Transl. into ENGLISH from German report KFK-851 Sponsored by USAEC-EURATOM (EURFNR-813) Avail: NTIS

The stability of the uncontrolled steam-cooled fast breeder reactor is investigated theoretically. This reactor permits oscillations of the power and the steam pressure. The possibility of such oscillations depends on the core stability, the delay time for the energy transport from the fuel to the evaporator, and the energy storage capacity of the cycle. The core stability proper depends on the reactivity coefficients and the pin power, among other factors. If the power decreases, the reactor approaches instability. For a given reactor the distance from the stability limit is shown as a function of reactor power and reactivity coefficient ratio. The influence of other parameters, such as those mentioned above and the steam pressure and temperature, on the stability limit is shown. The load dependent stability diagram chosen is compared with the usual stability presentation for full power. Author (NSA)

N71-35807# Kernforschungszentrum, Karlsruhe (West Germany).

COMPATIBILITY STUDIES WITH UC OF DIFFERENT STOICHIOMETRIES AND IRON-NICKEL-CHROMIUM ALLOYS AND THE INFLUENCE OF STABILIZERS

O. Goetzmann et al Jun. 1970 27 p refs Transl. into ENGLISH from German report KF-K-1213 Sponsored by USAEC-EURATOM

(EURFNR-820) Avail: NTIS

Compatibility tests were carried out at 900 C on Fe-Ni-Cr alloys and UC of differing carbon content and with stabilizers added. The carbon contents were 4.1, 4.8, and 5.22 wt %. Chromium and vanadium were used as stabilizers for fuels with the hyperstoichiometric composition and Cr23C6 and VC for the hypostoichiometric composition, respectively. The stabilizer was only mixed into the fuel powder. The mixture was not annealed to reach an equilibrium. No great effect of the stabilizers on the reaction of the hypostoichiometric fuel with the cladding materials was detectable. There was always a strong reaction. The interactions between the stoichiometric and hyperstoichiometric UC and the cladding materials were less than those found with the substoichiometric UC. The stabilizers had a definite effect on the reactions of hyperstoichiometric UC with the cladding materials. Author (NSA)

N71-35808# Kernforschungszentrum, Karlsruhe (West Germany).

FAST BREEDER PROJECT: TWO-YEARLY REPORT, 1968 - 1969

Jul. 1970 378 p Transl. into ENGLISH from German report KFK-1269 Sponsored by USAEC-EURATOM

(EURFNR-823) Avail: NTIS

Information on the development of fast breeder reactors is presented under the following headings: fuel design; production and irradiation of fuel rods; material development; corrosion tests and coolant analyses; work on fuel cycle; large physical experiments; reactor theory; safety of fast reactors; development of instrumentation and signal processing for core monitoring; effect of reactor incidents on the environment activity release; Na technology experiments; thermodynamic and hydrodynamic tests in gas and steam; reactor designs; and FR-3 fast high flux test reactor. NSA

N71-35809# Scottish Research Reactor Centre, East Kilbride.

REACTOR POWER UPGRADING, GEOCHRONOLOGY PROGRAMS, AND REACTOR RESEARCH 1969 - 1970

H. W. Wilson Jan. 1971 20 p refs

(SRRC-41/71) Avail: AEC Depository Libraries

Design modifications and experimental programs for the Scottish Universities Reactor are described. NSA

N71-35810# Bhabha Atomic Research Centre, Bombay (India).

WATER CHEMISTRY STUDIES: CHEMICAL ANALYSIS MANUAL FOR MODERATOR AND COOLANT WATER SYSTEMS

P. K. Mathur, A. S. Gokhale, and K. S. Venkateswarlu 1970

31 p
(BARC-515) Avail: AEC Depository Libraries

A strict control and regular monitoring of some of the specific dissolved impurities is essential. Procedures for the quantitative determination of submicrogram amounts of dissolved oxygen (less than 10 ppB), F(-), Cl(-), NO3(-), boric acid, Al(3+), Cr(3+), Fe(3+), Ni(2+), Cu(2+), and Zr(4+) in high-purity water were developed and standardized. Author (NSA)

N71-35811# Oak Ridge National Lab., Tenn.
ISOTOPES KILOWATT PROGRAM: FUELED CAPSULE DESIGN AND EVALUATION. A SAFETY ANALYSIS
K. W. Haff May 1971 60 p refs
(Contract W-7405-eng-26)
(ORNL-TM-3230) Avail: NTIS

A large heat source capsule design for the Isotopes Kilowatt Program which meets the containment criteria for safe operation in terrestrial systems and probable accident conditions is described. The capsule met all the requirements of operational safety and the particular hazards to which it might be exposed in its operational environment and transportation to and from its use site. Author (NSA)

N71-35812# Oak Ridge National Lab., Tenn.
ISOTOPE KILOWATT PROGRAM Quarterly Progress Report, period ending 31 Mar. 1971
May 1971 26 p refs
(Contract W-7405-eng-26)
(ORNL-TM-3394) Avail: NTIS

The detail design of the 1/4-scale organic fluid evaluation loop was completed. The heat block forging was procured and the specifications for the pumps are out for bids. A glass loop was built to mock-up the 1/4-scale organic fluid test loop. Results of operation experience analyses indicate that good startup, fluid flow stability, and control precision characterize the loop. Both startup and operating tests at 1000 to 1500 F were made on the heat pipe. No performance data were obtained. The heat pipe for the thermoelectric module was completed. Fabrication of the thermoelectric module was completed and testing was initiated. The assembly of the test section for the next series of tests on the aluminum wire screen insulation was completed. Aluminum alloy 1100 has been selected for the fusible insulation for the organic and low-temperature (PbTe) thermoelectric units. Tests were started to determine the effective thermal conductivity of the aluminum screen insulation as a function of pressure. The design of the full-scale heat block-shield was completed. Author (NSA)

N71-35813# Argonne National Lab., Ill.
BUBBLE GROWTH AND COLLAPSE IN NARROW TUBES WITH NONUNIFORM INITIAL TEMPERATURE PROFILES
William Douglas Ford Dec. 1970 166 p refs
(Contract W-31-109-eng-38)
(ANL-7746) Avail: NTIS

Experimental data were obtained for both the bubble growth and collapse of Freon-113 in constant-diameter, vertical channels with nonuniform initial temperature profiles. The vapor growth was initated by either rapid depressurization of the test section or pulsing an electrode following a slow depressurization. The experiment was recorded using high-speed photography. For the slug expulsion from the hot portion of a constant-diameter test section, data ranging in initial superheat from 59 to 128 F were obtained. Data were obtained, ranging in initial superheat from 30 to 100 F, for the expulsion from the hot portion into the cold portion of the test section. Measurements of the void fraction during the expulsion process were made. Reentry data obtained for superheats ranging from 20 to 40 F. An analysis is given in which the momentum equation for the upper liquid slug and the energy equation for the vapor slug are coupled numerically to predict the growth of the vapor space. The energy equation accounts for not only the energy transported across the upper and lower liquid-vapor interfaces, but also that transported across the wall film-vapor interface. Author (NSA)

N71-35814# Oak Ridge National Lab., Tenn.
AN INTEGRATED SYSTEM OF NUCLEAR MATERIALS CONTROL AT OAK RIDGE NATIONAL LABORATORY
R. G. Cardwell, B. E. Foster, and J. C. Gower Apr. 1971 13 p ref
(Contract W-7405-eng-26)
(ORNL-4607) Avail: NTIS

Current emphasis on development of fuels for breeder reactor application has necessitated frequent intermixing and compressing of U-233, U-235, and PU-239 isotopes. To provide the highly accurate control system that assures safe operation of the facilities, all criticality, accountability, and radiation safety controls were integrated into a centralized system managed by a coordinator designated the Nuclear Materials Controller. Emphasis was placed on minimizing the spread of contamination and reducing the potential for a nuclear incident while at the same time maintaining a smooth, uninterrupted flow of materials with a minimum of paper work. The centralized system is composed of three integrated units: (1) the criticality control board;(2) the nuclear materials flowboard; and (3) the flip-sheet ledger system. The system has effectively and efficiently met all control requirements and provided both necessary and desirable safeguards without hindering the processing of materials. Author (NSA)

N71-35815# Oak Ridge National Lab., Tenn.
Sr 90 HEAT SOURCES
Roberta Shor, (ed.), Robert H. Lafferty, Jr., (ed.), and P. S. Baker, (ed.) May 1971 134 p refs
(Contract W-7405-eng-26)
(ORNL-IIC-36) Avail: NTIS

This includes purification, transportation, preparation of fuel forms, analytical methods, densification, encapsulation, source testing, and examination of used sources. Details of source preparation, encapsulation, and testing are given. Author (NSA)

N71-35816# General Electric Co., Sunnyvale, Calif. Breeder Reactor Development Operation.
SODIUM TECHNOLOGY DEVELOPMENT PROGRAM: MASS TRANSFER INVESTIGATIONS IN LIQUID METAL SYSTEMS Quarterly Progress Report, Dec. 1970 - Feb. 1971
Mar. 1971 43 p refs
(Contract AT(04-3)-189)
(GEAP-13539-16; QPR-16) Avail: NTIS

The number of materials studied was extended to include cladding candidates for oxide fuel (Types-304,-316, and -347 stainless steels and Incoloy 800). The temperature range of testing was increased to 1300 F, and temperature profiles, loop geometry, and sodium purity controls were established to better represent environments of large fast reactors. Oxygen concentration was maintained less than 5 ppM, well within recommended prototypic values. Increasing emphasis was placed on improving sodium impurity monitoring a d control. In-line devices are used to obtain rapid and, where possible, continuous indications of impurity changes. These include chromatography for cover gas, replacable flow-through sodium samplers, electrochemical cells for oxygen activity, diffusion cells for hydrogen concentration in sodium and on-line distillation. Two cold traps for control of sodium purity in test loops were modified with electromagnetic stirring devices to increase cleanup rate. Automatic controls were added on all operating loops for continuous and unattended operation with an accuracy of + or - 2 F. Author (NSA)

N71-35817# WADCO Corp., Richland, Wash. Hanford Engineering Development Lab.
EFFECTS OF FAST NEUTRON IRRADIATION ON CHROMEL/ALUMEL THERMOCOUPLES
N. C. Holtink 30 Mar. 1971 18 p refs Presented at the 19th Ann. Northwest Instrumentation Conf., Richland, Wash., 20 May 1971
(Contract AT(45-1)-2170)

(HEDL-SA-152; Conf-710510-1) Avail: NTIS

Preliminary results obtained during early phases of a program to determine the effects of fast neutron irradiation on reactor-grade thermocouples being considered for use in the FFTF coolant measurement system are presented. The test program includes comparisons of pre- and post-irradiation calibration, wire resistance, insulation resistance, and time response for twenty-two, 30-in. long, 0.0625 in. diameter, stainless steel sheathed, MgO insulated Chromel/Alumel thermocouples irradiated in EBR-2. The effects on performance bf wire homogeneity and its importance in relation to radiation effects and reactor instrumentation are studied. NSA

N71-35818# Oak Ridge National Lab., Tenn.
ENGINEERING DEVELOPMENT STUDIES FOR MOLTEN-SALT BREEDER REACTOR PROCESSING NO. 3
L. E. McNeese May 1971 97 p refs
(Contract W-7405-eng-26)
(ORNL-TM-3138) Avail: NTIS

Research progress is reported on: removal of protactinium from single fluid MSBR, effect of chemical processing on nuclear performance of an MSBR, reductive extraction experiments in a mild steel flow-through facility, electrolytic cell development, analysis of mass transfer in electrolytic cells, axial mixing in packed columns with high density fluids, removal of heat from packed-column contactors, and MSRE distillation experiment. NSA

N71-35819# Oak Ridge National Lab., Tenn.
MOLTEN-SALT FLUORIDE VOLATILITY PILOT PLANT: RECOVERY OF ENRICHED URANIUM FROM ALUMINUM-CLAD FUEL ELEMENTS
W. H. Carr, L. J. King, F. G. Kitts, W. T. McDuffee, and F. N. Miles Apr. 1971 78 p refs
(Contract W-7405-eng-26)
(ORNL-4574) Avail: NTIS

A molten-salt fluoride-volatility process for recovering decontaminated uranium from spent uranium-aluminum alloy ORR and LITR fuel elements clad in aluminum was successfully developed and demonstrated. The facilities and the process were essentially the same as those used for zirconium- and Zircaloy-clad fuels except that an aluminum-potassium-zirconium fluoride mixture was used as the carrier salt. The development included the processing of both unirradiated and irradiated fuel elements. The uranium concentration in the salt after fluorination ranged from less than 0.1 to 9 ppM; total nonrecoverable losses in scrubbers and waste salt averaged less than 0.9%. Dissolution of the fuel elements required 8 to 17 hr for 90% completion, and 12 to 25 hr for 100% completion; average dissolution, rates were 0.6 and 0.4 kg of aluminum/hr, respectively. Author

N71-35820# Idaho Nuclear Corp., Idaho Falls.
CHEMICAL PROGRAMS DIVISION 1970 Annual Report, 1970
J. R. Bower, (ed.) Mar. 1971 109 p refs
(Contract AT(10-1)-1230)
(IN-1457) Avail: NTIS

Operating experience in fuel processing and waste management at the ICPP for FY-1970 is summarized. Coprocessing of aluminum and zirconium fuels was successfully demonstrated, as was startup of the Waste Calcining Facility using in-bed combustion of kerosene with oxygen to supply the necessary heat. Technical support activities dealing with current and proposed operations at the ICPP are also presented. These include: corrosion studies on processing equipment and fuel storage facilities; dissolution of aluminum fuel; fluidized-bed denitration of uranyl nitrate; combustion-dissolution of graphite fuels; developments in electrolytic dissolution; pilot plant calcination of varied waste solutions; evaluation of cleanup techniques for selected gaseous and liquid waste streams; studies on preparation and properties of uranium aluminide; and results of a study of a conceptual processing plant for high-temperature gas-cooled reactor fuel. Author (NSA)

N71-35821# Atomic Energy Commission, New Brunswick, N.J.
SUMMARY OF THE RESULTS OF THE GENERAL ANALYTICAL EVALUATION PROGRAM, JANUARY - DECEMBER 1969
C. J. Rodden and E. H. Jacob Sep. 1970 29 p
(NBL-256) Avail: NTIS

Analytical results on PuO2-UO2 material were compared over a considerable range of plutonium content. Information was obtained on the stability of a mixed oxide containing 17.6% Pu by analyzing it at various times over the course of a year. Ten laboratories used various analytical methods and relative differences from the monthly mean are given. NSA

N71-35822*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CRITICALITY STUDY OF NASA SOLUTION REACTORS WITH 25.4-CENTIMETER DIAMETER CYLINDRICAL STAINLESS-STEEL TANKS
Thomas A. Fox, Robert A. Mueller, and Daniel Fiero Washington Sep. 1971 22 p refs
(NASA-TM-X-2381; E-6421) Avail: NTIS CSCL 18K

The solution reactors ZPR-I and ZPR-II have been modified to use 25.4-cm-diameter cylindrical cores. The fuel solution consists of enriched (93.2 percent U-235) uranyl fluoride salt UO2F2 dissolved in water and is variable in concentration. Bare-core criticality data from tests with both reactors are presented and compared with multigroup transport calculations for a range of fuel concentrations having hydrogen to uranium atom ratios from 73.7 to 280.5. Parameters studied include critical mass, fundamental prompt-mode decay constant, temperature coefficient, and incremental reactivity worth at delayed critical. Author

N71-35823# Oak Ridge National Lab., Tenn.
THORIUM CERAMICS DATA MANUAL VOLUME 3: CARBIDES
Sigfred Peterson and C. E. Curtis Apr. 1971 34 p refs
(Contract W-7405-eng-26)
(ORNL-4503(Vol-3)) Avail: NTIS

The thorium-carbon system is reviewed. Properties are listed for the monocarbide and dicarbide alone and in combination with other carbides, notably those of uranium and plutonium. Since the main interest in thorium carbides is for nuclear fuel, nearly as much information is available on the thorium-uranium carbides as on the pure carbides. Uncertainties in composition and impurity content lead to disagreement on many key properties. Author (NSA)

N71-35824# Hanford Engineering Development Lab., Richland, Wash.
MICROSTRUCTURE CHARACTERISTICS OF PNL-6 IRRADIATION TEST FUEL
M. C. J. Carlson Mar. 1971 27 p refs
(Contract AT(45-1)-2170)
(HEDL-TME-71-45) Avail: NTIS

An extensive program of fuel characterization was developed to provide quantitative porosity characterization, grain structure characterization, and composition distribution measurements for as-fabricated mixed-oxide test fuels to a level consistent with anticipated postirradiation examination of the fuel. Quantitative microstructure characteristics are shown for representative fuel fabrication batches in EBR-2 irradiation subassembly PNL-6. The evaluation results show that excellent reproducibility of porosity characteristics within and among fuel batches can be achieved by close process control. Results of evaluation of composition distributions show that the mechanical mixing process used in preparation of PNL-6 fuel has produced a high degree of compositional uniformity. Author (NSA)

N71-35825# Research Inst. of National Defence, Stockholm (Sweden).
DETERMINATION OF CRITICAL MASS FOR AN

UNDILUTED CORE WITH CENTRAL AIR GAP IN THE FRO FAST REACTOR [BESTAEMNING AV KRITISK MASSA FOER OUTSPAEDD HAERD MED CENTRALT LUFTGAP VID SNABBA REAKTORN FRO]
J. Kockum and L. G. Larsson Jan. 1970 9 p refs In SWEDISH
(FOA-4-C-4412-22) Avail: NTIS

A critical experiment was conducted at the FRO fast reactor, with an undiluted, copper reflected cylindrical core with a central air gap. It was performed to give the experimental control possibilities of calculating criticality carried out on a complicated geometry system by means of the Monte Carlo technique. At a radius of 16.9 cm, height 29.7 cm and air gap of 2.29 cm the critical mass was 447 + or - 2 kg uranium (20% concentration), and at a height of 36.6 cm and air gap of 4.57 cm the critical mass was 529 + or - 3 kg of uranium. With the latter amount of uranium in the reactor the degree of subcriticality was also determined for air gaps up to 19.6 cm.
Author

N71-35826# Atomics International, Canoga Park, Calif.
HELIUM PRODUCTION IN STAINLESS STEEL AND ITS CONSTITUENTS AS RELATED TO LMFBR DEVELOPMENT PROGRAMS
W. N. McElroy and H. Farrar, IV May 1971 63 p refs Presented at the Intern. Conf. on Radiation - induced Voids in Metals, Albany, 9-11 Jun. 1971
(Contracts AT(45-1)-2170; AT(04-3)-824)
(HEDL-SA-193; Conf-710601-2) Avail: NTIS

Information on helium production in stainless steel and its constituents to provide a basis for predicting helium generation rates for the correlation and interpretation of irradiation effects data is presented. Author (NSA)

N71-35827# Westinghouse Electric Corp., Madison, Pa. Advanced Reactors Div.
TRANSIENT EFFECT ON LMFBR FUEL RODS BY GAS BUBBLES ENTRAINED IN THE COOLANT
Mario D. Carelli and Ezra D. Shous [Jul. 1970] 18 p refs Presented at Am. Nucl. Soc. Meeting, Los Angeles, 29 Jun. 1970
(Contract AT(30-1)-4135)
(Conf-700608-38) Avail: NTIS

The effect of the intermittent passage of gas bubbles entrained in the sodium coolant on the integrity of the fuel rod cladding is examined for typical conditions of liquid metal fast breeder reactors. The maximum stable size of the bubbles is calculated to be of the order of 0.5 in equivalent spherical diameter. The transient blanketing of the fuel rod due to the bubbles is studied for two extremely conservative geometrical configurations. The maximum calculated cladding temperature increase during the transient was found to be fairly limited, and the thermal fatigue effect due to the passage of a large number of bubbles was assessed. It appears that even in the most pessimistic conditions the fatigue effect is well below the failure limit. It was concluded, therefore, that gas bubbles flowing through the core do not endanger the cladding integrity and do not reduce the fuel rod lifetime. Author (NSA)

N71-35828# Oak Ridge National Lab., Tenn.
COMPARISONS BETWEEN PREDICTED AND MEASURED FUEL PIN PERFORMANCE
F. J. Homan, C. M. Cox, and W. J. Lackey May 1971 26 p refs Presented at Conf. on Fast Reactor Fuel Element Technol., New Orleans, 13 Apr. 1971
(Contract W-7405-eng-26)
(ORNL-TM-3386; Conf-710414-3) Avail: NTIS

The FMODEL computer code is being developed to predict and analyze the irradiation performance of stainless steel clad (U,Pu)O2 LMFBR fuel pins in terms of thermal and mechanical performance. Detailed comparisons were made between predicted and measured fuel pin performance in terms of cladding deformation, oxide fuel restructuring, and fuel temperatures. Reasonable agreement was obtained in each of these comparisons without resorting to the use of artificially adjusted parameters to fit the data. It is concluded that, while added sophistication will improve the performance predictions, the current version of FMODEL is a reliable tool for design analysis and interpretation of irradiation tests. Author (NSA)

N71-35829# Oak Ridge National Lab., Tenn. Mathematics Div.
DESIGN CONSIDERATIONS OF REACTOR CONTAINMENT SPRAY SYSTEMS. PART 12: VARIABILITY OF THE DOSE REDUCTION FACTOR FOR THE REMOVAL OF ELEMENTAL IODINE
Thomas L. Hebble May 1971 25 p refs
(Contract W-7405-eng-26)
(ORNL-TM-2412-Pt-12) Avail: NTIS

Pressurized water reactors have containment spray systems installed as engineered safety features. These systems serve as heat removal devices and in a number of cases function as an iodine removal system. The dose reduction factor is used in the evaluation of the containment vessel spray systems that are designed for the removal of atmospheric contaminants. The variability of this factor for the specific removal of elemental iodine is analyzed. Two aspects of variability are considered. First, a method is given for estimating the variance of the dose reduction factor as a function of two random variables; spray drop diameter and spray drop velocity. This method also provides insight into the behavior of the variability at different levels of controllable process variables. Second, an estimate of the variance is based on observations from three repeated Nuclear Safety Pilot Plant (NSPP) runs. Author (NSA)

N71-35830# Gulf General Atomic, San Diego, Calif.
HTGR BASE PROGRAM Quarterly Progress Report, Period ending 28 Feb. 1971
30 Mar. 1971 107 p
(Contract AT(04-3)-167)
(GA-10501) Avail: NTIS

Studies of basic fission-product distribution mechanisms; recycle fuel including designing and testing of recycle test elements, development of a national recycle plan and of a recycle fuel plant, and exploration of head-end reprocessing methods; and physics and fuel management including design and fabrication of fuel test elements, and physics tests performed in a HTGR are reported. Materials studied include irradiation and analysis of fuel particles in capsules to evaluate startup and recycle fuel systems, and basic studies of control materials and of carbon and graphite. Experimental procedures and results are discussed and data are presented in tables, graphs, and photographs. Author

N71-35831# Gulf General Atomic, San Diego, Calif.
PUBLIC SERVICE COMPANY OF COLORADO 330-MW(E) HIGH-TEMPERATURE GAS-COOLED REACTOR RESEARCH AND DEVELOPMENT PROGRAM Quarterly Progress Report, period ending 31 Mar. 1971
30 Apr. 1971 112 p
(Contract AT(04-3)-633)
(GA-10560) Avail: NTIS

Studies of component development for HTGR, such as auxiliary equipment and special tools, and nuclear analysis of the fuel cycle, fuel zoning, and power shaping are reported. Studies of fuel element design, core materials development and testing, and demonstration testing of the performance of test fuel elements by means of irradiation at expected operating temperatures are included along with studies covering the components of the steam generator under operating conditions. A continuing study of process variables for the fabrication of coated fuel particles, is discussed. Experimental procedures and results are discussed and where appropriate, the data are presented in tables, graphs, and photographs. Author

N71-35832# Oak Ridge National Lab., Tenn.
HIGH FLUX ISOTOPE REACTOR Quarterly Report, Jan. - Mar. 1971
R. V. McCord and B. L. Corbett 17 May 1971 26 p
(Contract W-7405-eng-26)
(ORNL-TM-3432) Avail: NTIS

Operation of the HFIR was routine with an on-stream time of 94.5%. An even higher operating time percentage could have been achieved but one of the four end-of-cycle shutdowns was a long shutdown for maintenance and semiannual inspection. Routine usage of fuel elements without plate-spacer combs was started. Operation with these elements was normal and the total system flow rate was higher as expected. Author (NSA)

N71-35833# Hanford Engineering Development Lab., Richland, Wash.
FFTF: COMPANION TEST AND DEVELOPMENT FACILITY FOR THE LMFBR PROGRAM
W. M. Gajewski, W. H. Esselman, B. Wolfe, and J. J. Taylor [1970] 21 p refs Presented at the Conf. on Fast Reactors, Palo Alto, Calif., 7 Mar. 1971
(Contract AT(45-1)-2170)
(WHAN-SA-104-Rev; Conf-710315-1) Avail: NTIS

The Fast Flux Test Facility is the reactor test complex which will be used to aid in the solution of the fuels and materials problems which are most critical to the development of a liquid metal cooled fast breeder reactor. The FFTF and its design features, including those that are unique to this test facility and those which are prototypic of expected future reactors are described. The operation of the FFTF is also discussed.
Author (NSA)

N71-35834# Atomic Energy Commission, Oak Ridge, Tenn. Div. of Technical Information Extension.
REACTOR SAFETY: A LITERATURE SEARCH
Henry D. Raleigh, (comp.) Jun. 1971 63 p refs
(TID-3525-Rev-5-Suppl-6) Avail: NTIS

Included are 243 citations to references issued during 1970 on safety aspects of nuclear reactor design, materials, engineered safeguards, and operating procedures. Reports cited concern hazards analyses of entire facilities to satisfy construction and operation permit requirements, evaluation of reactor systems and components reliability, and analyses of the consequences of potential accident conditions. Subject, author, corporate author, and report number indexes are included. NSA

N71-35835# Waseda Univ., Tokyo (Japan). Dept. of Science and Engineering.
PROBLEMS ABOUT FUEL CLADDING MATERIALS: STAINLESS STEEL
Masayoshi Hasegawa 1970 7 p Presented at the Japan Atomic Energy Soc. Meeting, Tokyo, 12-13 Feb. 1970
(Conf-700211-7) Avail: NTIS

Test data are presented on the high temperature creep properties, elongation, ductility, neutron irradiation effects, and corrosive effects of flowing sodium. NSA

N71-35836 National Lending Library for Science and Technology, Boston Spa (England).
LOCAL HEAT TRANSFER IN A FUEL ELEMENT MADE UP OF HELICAL-FIN PARALLEL-FLOW PINS [DER OERTLICHE WAERMEUEBERGANG IN EINEM AUS SPIRALENFOERMIG BERIPPTEN UND PARALLEL ANGESTROEMTEN STAEBEN GEBILDETEN REAKTORBRENNELEMENT]
W. Eifler (Euratom, Ispra, Italy) et al 20 Apr. 1971 34 p Transl. into ENGLISH from Nucl. Eng. and Design (Amsterdam), no. 9, 2 Feb. 1969 p 211-233
(NLL-Windscale-Trans-397-(9091.9F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 4 NLL photocopy coupons

A description is given of heat transfer experiments in an assembly of four helically finned pins. The aim was to provide thermal design information for 7-rod fuel elements developed in the framework of the ORGEL Project. Heat transfer was studied in an annular test section for a concentric and a completely eccentric test rod mounting. The results obtained were employed to furnish a detailed analysis of subsequent measurements in a 4-pin test section. To evaluate local heat transfer coefficients, temperatures were measured inside the thermal fins of the experimental cans. A simple calculation method is indicated to interpret these temperature measurements. Author

N71-35837 National Lending Library for Science and Technology, Boston Spa (England).
SAFETY PROBLEMS OF FAST SODIUM-COOLED REACTORS
K. Gast May 1971 6 p refs Transl. into ENGLISH from Procs. Ger. Atom Forum, Berlin, 20-22 Apr. 1970, p 42-45
(NLL-Risley-Trans-2083-(9091.9F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

A qualitative analysis of all conceivable courses of possible accidents, the problems caused by such accidents, and the procedures followed to insure safety are determined for sodium cooled reactors. Three courses of action are proposed for safety measures: (1) analysis of the reasons, the temporal course and accompanying and secondary phenomena of local disturbances, (2) development of special instruments for individual control of each single fuel element, and (3) an investigation of the maximum consequences of the fuel sodium reaction in individual fuel elements as the last member of a hypothetic chain of events before an accident is induced. E.H.W.

N71-35838 National Lending Library for Science and Technology, Boston Spa (England).
SELECTION OF SPACES FOR FAST BREEDER REACTOR FUEL ELEMENTS
W. Baumann et al [1971] 7 p refs Transl. into ENGLISH from Fast Reactor Fuel and Fuel Elements Conf. (Karlsruhe), paper 47, 1970
(NLL-Risley-Trans-2102-(9091.9F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The selection of spacers for fast breeder reactor fuel elements is discussed based on fuel element geometries and operating conditions. Pressure drop as a function of the length between pin supports in the bundle; coolant cross-mixing; coolant temperature distribution in the bundle cross section as a function of the cross-mixing for uniform and unsymmetrical bundle loading; and the local temperatures at the pin support points in the bundle were investigated for five different spacers. J.M.

N71-35839 National Lending Library for Science and Technology, Boston Spa (England).
EQUATIONS OF STATE FOR UC AND PuC NUCLEAR FUELS
H. Hoffmann et al May 1971 8 p Transl. into ENGLISH from J. Nucl. Mater. (Amsterdam), v. 38, 1971 p 105-113
(NLL-Risley-Trans-2143-(9091.9F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The caloric and thermal equations of state are used to calculate the effects of severe excursion on fuel power in fast reactors. The results indicate that under excursion conditions, UC and PuC are more reliable fuels than UO2. E.H.W.

N71-35840 Rensselaer Polytechnic Inst., Troy, N.Y.
THE DESCRIPTION OF SPACE TIME DYNAMIC BEHAVIOR OF NUCLEAR REACTOR SYSTEMS
Paul Charles Rohr (Ph.D. Thesis) 1970 178 p
Avail: Univ. Microfilms Order No. 70-19049

Semi-direct modal synthesis methods are studied. Green's function modes are used and the considerations are limited to one-dimensional slab geometry. Some extensions to other geometries and more energy groups are included. Galerkin, least squares variations, and discontinuous variational method are

studied to determine figures of merit that predict how well the formulation uses the information in the modes and how well the formulation and the modes can synthesize in both space and time. The discontinuous variational method (DVM) performed significantly better over a range of problems than did either of the other methods. Further tests of the DVM included larger size perturbations, localized positive perturbations, and an eigenvalue spectrum analysis that measured the ability of the formulation to predict higher eigenvalues. The ability of the DVM to synthesize peaks in the overtones, where there is no peak in the trial functions, is clearly demonstrated. Dissert. Abstr.

N71-35841 Iowa State Univ. of Science and Technology, Ames.
SPATIALLY DEPENDENT STOCHASTIC BEHAVIOUR OF COUPLED CORE REACTORS
Mohamed El-Sayed Negy (Ph.D. Thesis) 1970 111 p
Avail: Univ. Microfilms Order No. 70-18896

The behavior of the space-dependent spectral-density functions for the thermal group flux of a two-energy group approximation for a one dimensional model of an Argonaut-type reactor is analyzed. The input function is assumed to be white noise generated by volume distributed fission sources. The effect of changing the thickness and material of the coupling region(internal reflector) is described. Graphite, heavy water, and beryllium are considered as internal reflectors. The effect of the fast removal and thermal absorption cross sections of the coupling region is also investigated. A neutron wave model is used to explain trends predicted by the noise model. The behavior of the sink frequency associated with the cross spectrum is described as a function of the coupling region parameters. The sink frequency is defined, for a symmetrical reactor, as the frequency at which the cross spectrum passes through zero. For a symmetrical reactor and observation points the cross spectrum is real. The sink frequency is sensitive to the size and nuclear properties of the coupling region.
Dissert. Abstr.

N71-35842 California Univ., Berkeley.
NEUTRON AMPLIFICATION AND APPLICATION TO A FLUX TRAP REACTOR
Panayiotis Karousakis (Ph.D. Thesis) 1970 143 p
Avail: Univ. Microfilms Order No. 70-18679

The feasibility of a high flux research reactor is studied based on Borst's idea of the convergatron. The problem is studied from various points of view with the main emphasis on generalized multienergy group point kinetics. An explicit treatment and definitions of the effective surface sources at the various interfaces is included. Two computer codes, the DTF 4 transport code and the EQUIPOISE diffusion code, are extensively employed and the results are analyzed and used in obtaining coupling coefficients and kinetics parameters. Preliminary results show that such a reactor system is indeed feasible up to second order effects and holds promise for future research in realizing very high neutron fluxes for irradiation and other purposes. The proposed reactor furthermore, is superior to a reactor system of the same size and critical mass, but with the fissile material uniformly dispersed over the whole core, and compares favorably with other flux trap reactors such as the HFIR and the ATR reactors. Dissert. Abstr.

N71-35843 California Univ., Berkeley.
TRANSIENT HEAT TRANSFER PERFORMANCE OF A REACTOR COOLANT CHANNEL DURING ACCIDENTAL POWER EXCURSIONS
Adinarayantampi Gopalakrishnan (Ph.D. Thesis) 1969 313 p
Avail: Univ. Microfilms Order No. 70-17569

A comprehensive computer program was developed for the numerical solution of the general problem of transient heat transfer to steady, fully developed turbulent flow through parallel wall channels. The program essentially solves for the two-dimensional transient temperature fields within the fuel region and the coolant, using either the Deissler or the Karman-Martinelli eddy diffusivity for heat in the fluid. The program has the built-in capability to handle arbitrary temperature dependence of the plate thermal properties, arbitrary space and time dependence of the wall heat source as well as time-dependent inlet coolant temperature distributions. Axial conduction effects are included both in the fuel plate and the coolant. Numerical results were obtained primarily for exponentially increasing heat generation rates within the plate, with e-folding times in the range 1.0 ms < or = to t(0) < or = to 50.0 ms; Reynolds numbers in the range 40,000 < or = to Re < or = to 300,000 used and results are presented both for Pr = 0.82 (Water) and Pr = 0.004 (Liquid Sodium).
Dissert. Abstr.

N71-35844 Purdue Univ., Lafayette, Ind.
IMPROVED FAST REACTOR SPACE ENERGY SYNTHESIS
John Edwin Cockayne (Ph.D. Thesis) 1970 112 p
Avail: Univ. Microfilms Order No. 70-18815

A factorization technique using an approximate synthesis solution was developed for calculating the spectrum, at any location in the reactor, from a zero dimensional problem. In the transition area around the interface, this factorized spectrum is substantially better than the good two mode synthesis results, and much better than any spectrum calculated for this transition area which is not based on an approximate solution. The availability of realized spectra, from an approximate two spectra solution and the factorization technique, led to devising a successive synthesis approach where the synthesis is applied twice. The approach has led to highly accurate energy-integrated quantities for three mode (one original and two new) applications to two region problems. The successive space-energy synthesis has great potential for power flattened (i.e., multi-region) fast reactor configurations. Dissert. Abstr.

23 PHYSICS, GENERAL

Includes acoustics, cryogenics, mechanics, and optics. For astrophysics see: 30 Space Sciences. For geophysics and related information see also: 13 Geophysics; 20 Meteorology; and 29 Space Radiation.

N71-35845*# Massachusetts Inst. of Tech., Cambridge. Measurement Systems Lab.
PSEUDO-DIAMAGNETIC SUSPENSION
Leonard S. Wilk Jun. 1971 60 p refs
(Contract NAS9-8328)
(NASA-CR-115140; RN-66) Avail: NTIS CSCL 20C

A device that develops forces in a magnetic field as though it were composed of diamagnetic material is described. Since a diamagnetic material can be stably suspended (i.e. levitated) in a properly shaped magnetic field, this device or its principles may be useful for suspension applications. As such, it is called pseudo-diamagnetic suspension. The forces developed can be substantially larger than those developed in conventional diamagnetic suspension systems. This device requires electrical components and an energy source, but it can be completely self contained in that it need sense only its internal conditions. In some designs, this energy requirement can be made significantly small. A laboratory experiment is described where a stable suspension was provided at the rate of 232 kg/watt. The analogous electric field case is also analyzed, where a device develops forces in an electric field as though it were composed of material with a permittivity less than that of free space. This is called pseudo-dielectric suspension. It simulated no known natural phenomenon. Author

N71-35846*# Translation Consultants, Ltd., Arlington, Va.
NUMERICAL SOLUTIONS OF INTRINSICALLY STEADY-STATE PROBLEMS OF ELECTRODYNAMICS [CHISLEN-

NOYE RESHENIYE VNUTRENNIKH STATSIONARNYKH ZADACH ELEKTRODINAMIKI]
L. M. Degtyarev et al. Washington NASA Sep. 1971 15 p refs Transl. into ENGLISH from Zh. Vychislitelnoi Mat. i Mat. Fiz (Moscow), v. 10, no. 6, 1970 p 1409-1418
(Contract NASw-2038)
(NASA-TT-F-13565) Avail: NTIS CSCL 20C

A difference scheme of the second order of accuracy with a positive operator has been derived for the solution of a mixed boundary-value problem. Several iterative operations based on the method of variable directions were used for the solution of a steady-state difference problem. The comparison of various alogrithms was carried out. Solutions for specific problems in the areas of magnetohydrodynamics, ionization instability in a low-temperature plasma, and magnetic gas dynamics were given as examples. Author

N71-35847*# Rensselaer Polytechnic Inst., Troy, N.Y.
PHOTODETACHMENT OF VARIOUS CONDENSED CASES AT LOW TEMPERATURES UTILIZING ULTRAVIOLET LIGHT
David C. Ellmann (Ph.D. Thesis) Jun. 1971 100 p refs
(Grant NGL-33-018-007)
(NASA-CR-121938) Avail: NTIS CSCL 20L

The photodetachment of various condensed-gas molecules including carbon dioxide, ammonia, and nitrous oxide at low temperatures was investigated utilizing ultraviolet light to simulate solar system conditions. Photodetachment efficiencies in the order of 0.0001 molecules per photon were observed. The pressure change due to irradiation with the 2062 A line was directly and linearly proportional to the intensity of the impinging light. No evidence was found to support the occurrence of a dissociation effect in the solid phase of the gases. The symmetry of the detachment-recondensation traces supported the sampling results which also indicated no dissociation. J.M.

N71-35848*# Worcester Polytechnic Inst., Mass. Dept. of Physics.
A STATISTICAL ANALYSIS OF SOME NON-LINEAR OPTICAL EFFECTS Final Report
E. L. O'Neill, L. Estes, L. Narducci, and W. Clark 20 Aug. 1971 130 p refs
(Grant NGR-22-017-019)
(NASA-CR-121935) Avail: NTIS CSCL 20F

The photoelectron counting distribution for second harmonic light generated by a monochromatic, single mode, thermal light source is calculated using a suitably modulated laser beam for the light source. Statistical properties of a light beam scattered by two rotating ground glasses were obtained. Photocount statistics measured at different translational speeds confirmed that the scattered light amplitude is a stochastic Gaussian variable in that there are many scatterers in the illuminated region. In addition, a theorem in applied optics dealing with the upper bound of the optical transfer function is submitted. E.M.C.

N71-35849*# Translation Consultants, Ltd., Arlington, Va.
SUBJECTIVE AND OBJECTIVE EVALUATION OF ENGINE NOISES [SUBJEKTIVE UND OBJEKTIVE BEWERTUNG VON MASCHINENGERAEUSCHEN]
E. Luebcke et al. Washington NASA Sep. 1971 19 p refs Transl. into ENGLISH from Acustica (Stuttgart), v. 14, 1964 p 105-114
(Contract NASw-2038)
(NASA-TT-F-13943) Avail: NTIS CSCL 20A

The same magnetic tape recordings of a great number of noises produced by reciprocating combustion engines served as a basis for the evaluation of noises at two different places (Berlin, Stuttgart) using subjective noise measurements. The total sound pressure level was kept constant at 80 db (headphone was calibrated in free field, loudspeaker in free field). The mean values of the measurements at Berlin and Stuttgart show a standard deviation of 2.4 db + or - 2.1 db. The objective evaluation was made by measuring the sound levels in db(A) and db(B). The loudness was calculated following Zwicker from third octave spectra, and Stevens from the octave spectra. The value calculated according to Zwicker stands closest to the subjective mean values. The evaluation of the octave spectra by limiting curves gives information, which deviates in some cases from the sound level in db(A). Author

N71-35850*# Scientific Translation Service, Santa Barbara, Calif.
NOISE CONTROL IN WOODWORKING MACHINES [BOR'BAS SHUMOM DEREVOOBRABATYVAYUSHCHIKH STANKOV]
A. F. Kozyakov Washington NASA Sep. 1971 6 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Lesnoy Zhurnal (USSR), no. 12, 1966 p 124-129
(Contract NASw-2035)
(NASA-TT-F-13900) Avail: NTIS CSCL 20A

Noise characteristics of woodworking machines were experimentally studied. An analysis is made of the noise spectra. The greatest noise and vibration sources are identified and methods of reducing them are determined. Author

N71-35851*# Massachusetts Inst. of Tech., Cambridge. Measurement Systems Lab.
THE RELATIVE MOTION OF UNRESTRAINED BODIES WITHIN ORBITING SPACE STATIONS
William N. Lee Dec. 1970 33 p refs
(Contract NAS8-8328)
(NASA-CR-115142; RE-76) Avail: NTIS CSCL 20K

Recent analyses of several experiments proposed for an earth orbiting space station have shown it advantageous to allow the experiments to float freely inside the spacecraft. Perturbating forces and/ or experimental locations at other than the center of mass, however, will cause relative motion between the experimental apparatus and the spacecraft. A linearized perturbation method is presented for calculating the relative motion, including the prediction of possible collision with the spacecraft. The theory is then applied in detail to two probable attitude orientation modes of a Skylab vehicle in earth orbit. Author

N71-35852# National Defense Research Organization TNO, the Hague (Netherlands). Physics Lab.
SEQUENTIAL DETECTION IN TWO STEPS LABORATORY MEASUREMENTS WITH THE MINICAS SET-UP [SEQUENTE DETECTIE IN TWEE STAPPEN: LABORATORIUMMETINGEN AAN MINICAS-OPSTELLING]
G. A. van der Spek Jan. 1971 26 p refs In DUTCH; ENGLISH summary
(Ph L-1971-2; Rept-58099) Avail: NTIS

Two ways of detection of non-fluctuating targets in white normal noise have been compared: (1) sequential detection with truncation after the second step and (2) conventional detection with one signal pulse. The measured and the computed gain of sequential detection were in good agreement. Author

N71-35853# Atomic Energy Commission, Washington, D.C.
FINAL SIMPLIFICATION OF WINDING PRODUCING A MAGNETIC CONFIGURATION OF THE STELLARATOR TYPE
Christian Gourdon et al [1971] 5 p refs Transl. into ENGLISH from Comp. Rend., Ser. B (Paris), v. 271, Oct. 1970 p 843-845
(AEC-tr-7208) Avail: NTIS

Windings producing a magnetic configuration of the stellarator type are described. For two windings, a toroidal winding that produces an azimuthal field B sub theta and a helicoidal winding spaced evenly on a torus, the conductors turn while making m small turns for one large turn of the torus. These carry currents that are equal and circulate in the same direction. A third winding produces a uniform field B sub z that is intended to compensate, on the average, for the component B sub z produced by the helicoidal currents. NSA

N71-35854# Royal Aircraft Establishment, Farnborough (England).
VARIATION OF GAMMA AS A FUNCTION OF THE WAVELENGTH OF THE EXPOSING LIGHT SOURCE [VARIATION DU GAMMA EN FUNCTION DE LA LONGUEUR D'ONDE]
H. Sauvenier et al Apr. 1971 13 p refs Transl. into ENGLISH from Sci. Ind. Phot. (Paris), v. 22, no. 9, 1951 p 330-335
(RAE-LIB-TRANS-1572) Avail: NTIS

It was assumed from previous publications with regard to gamma as a function of the wavelength that the results are influenced by emulsions, lighting or developers used. A large series of tests were made using four different types of emulsions which were either non-chromatised, orthochromatised or panchromatised. The tests were made for the same light condition, at different exposure times or vice versa; the negatives were developed either in surface developers or in developers acting also on the internal latent image. In conditions such that the same density may be obtained for one time exposure at different spectral regions, transmitted by colored filters, the variation of gamma as a function of wavelength does not seem to obey any general law. Author

N71-35855# National Aeronautical Establishment, Ottawa (Ontario).
EFFECTIVE SOURCE DISTRIBUTION IN A CHOKED SCREECH JET
B. H. K. Lee and R. Westley May 1971 42 p refs
(NRC-12111; LR-548) Avail: NTIS

Using experimental measurements of the sound pressure and phase in the near field of a choked screech jet, a method is proposed for computing the effective source positions, strengths, and phases. Two models are considered. The first assumes a distribution of point sources along the jet axis and the second assumes ring sources along the jet boundary. A technique of minimization is used and a solution is obtained when the sum of squares reaches a minimum. Results for a choked jet at a screech frequency of 3170 c/s are presented. Author

N71-35856*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
IMPROVED TRANSMITTANCE MEASUREMENTS IN A MAGNESIUM OXIDE COATED INTEGRATING SPHERE
Robert L. Bowman, Ernie W. Spisz, and J. Perry Campbell Washington Sep. 1971 5 p refs
(NASA-TM-X-2395) Avail: NTIS CSCL 20F

A simple and convenient technique which was found to be useful for extending the transmittance measurement capability at low (near ultraviolet) wavelengths for a conventional magnesium oxide coated integrating sphere system is described. The technique is to place a sodium salicylate coated disk in the center of the integrating sphere. With the coated disk, the detector output is increased; accurate transmittance measurements can be made to wavelengths of 0.25 micrometers with a tungsten lamp and to 0.22 micrometers with a deuterium lamp, whereas previous transmittance measurements had been limited to wavelengths of 0.32 and 0.26 micrometers respectively. Author

N71-35857# Rome Univ. (Italy). Inst. of Physics.
STATIC SCALING LAWS AND THE PRESENT EXPERIMENTAL SITUATION
M. Vincentini-Missoni 8 Oct. 1970 18 p refs /tz Nota Interna No. 287
Avail: NTIS

The scaling law hypothesis for the equation of state in the critical region of fluids and magnets is discussed in relation to experimental data. Properties of the asymptotic equation of state in the scaling formulation are then reviewed. Various proposals of closed form expressions for the equation of state, including the linear model parametric transformation, are compared with experimental data. Author (ESRO)

N71-35858# Research Inst. of National Defence, Stockholm (Sweden).
DATA PROGRAM FOR CALCULATING COLOUR COORDINATES FROM THE COLORIMETER VALUES AND FOR CALCULATING COLOUR DIFFERENCES [DATORPROGRAM FOER BERAEKNING AV FAERGKOORDINATER UR KOLORIMETERVAERDEN SAMT FOER BERAEKNING AV FAERGDIFFERENSER]
Peter Steen Mar. 1970 17 p refs In SWEDISH
(FOA-2-C-2386-51) Avail: NTIS

A computer program to calculate color values and color coordinates is discussed. The color values are measured from 3 or 4 filter color meter. The units of color differences are estimated. Author

N71-35859# Research Inst. of National Defence, Stockholm (Sweden).
OPTICAL TECHNIQUES FOR OBSERVATIONS UNDER WATER [OPTISK TEKNIK FOER UNDERVATTENSOBSERVATION]
J. Lexander Mar. 1970 18 p refs In SWEDISH
(FOA-2-C-2385-58) Avail: NTIS

An optical technique for undersea observations is presented. Problems associated with the propagation of light rays in water are discussed. The development of optical observation equipment for use in underwater activities is described. Author

N71-35860# Research Inst. of National Defence, Stockholm (Sweden).
ELECTRO-OPTICAL EFFECT IN LiNbO3 [ELEKTROOPTISK EFFEKT I LBO3]
Barbro Lindeberg Mar. 1970 10 p refs In SWEDISH
(FOA-1-C-2377-51) Avail: NTIS

The electro-optical effect in LiNbO3 has been studied at a wavelength of 6328 angstroms. The optical beam passed the crystal in the 100-direction and the electric field was parallel with 001. The voltage required for a half wave length phase displacement has been measured. The attenuation for a system consisting of a LiNbO3 crystal and one quarter lambda plate between crossed polarisers has been measured as at least 20:1. Author

N71-35861# Research Inst. of National Defence, Stockholm (Sweden).
SOUND ABSORPTION COEFFICIENT IN THE SEA OVER THE FREQUENCY RANGE 0.1-50 kHz, AS A FUNCTION OF TEMPERATURE AND SALINITY [LJUDABSORPTIONSKOEFFICIENTEN I HAVET FOER FREKVENSOMRAEDET 0,1 - 50 KHZ SOM FUNKTION AV TEMPERATUR OCH SALTHALT]
Tore Pentelius Jan. 1970 11 p refs In SWEDISH
(FOA-3-C-3620-57) Avail: NTIS

A summary of certain experimental results concerning the absorption of sound at low frequencies is presented. Experiments show that the absorption at low frequency is higher than that obtained by extrapolation from measurements carried out at higher frequencies. Nomograms and tables for the determination of the absorption coefficient are presented. Author

N71-35862# Forsvarets Teletekniska Lab., Stockholm (Sweden).
REPORT ON INVESTIGATIONS INTO ACCELERATION MEASUREMENTS MADE ON INSTRUMENTS DURING TRANSPORT IN A SMALL DELIVERY VAN [RAPPORT OEVER UNDERSOEKNING AV ACCELERATION SMAETNIGAR GJORDA PA INSTRUMENT UNDER TRANSPORT I MINDRE SKAPBIL]
L. Pejfert and L. Waemberg Mar. 1970 24 p In SWEDISH
(FTL-A-AI008-14) Avail: NTIS

The results of acceleration measurements carried out on instruments when being transported in a small delivery van over snow-covered roads, are reported. A loose lying instrument was

subjected all the time to a greater acceleration stress than an instrument that was firmly secured in the baggage space or was in its packing case. The accelerations measured fell between 1 and 7 g, 0.25-12 ms. Author

N71-35863# Naval Ship Research and Development Center, Washington, D.C.
INTEGRAL EQUATION METHODS IN SOUND RADIATION AND SCATTERING FROM ARBITRARY SURFACES
Research and Development Report
George Chertock Jun. 1971 64 p refs
(AD-726404; NSRDC-3538) Avail: NTIS CSCL 20/1

Integral equation methods are described for calculating the entire sound pressure field when either the distribution of velocity or sound pressure is specified on an arbitrary closed surface. The theory is based on determining an equivalent surface layer of either monopoles only, dipoles only, or both monopoles and dipoles. Appropriate integral equations are derived for the unknown surface monopole and/or dipole density for each case and each boundary condition. Every closed surface has two infinite sequences of characteristic wave numbers at each of which there exist an associated characteristic internal standing wave and an associated characteristic external traveling wave which satisfy the homogeneous parts of these integral equations at one or the other of the two series of wave numbers. At these wave numbers, and for particular boundary conditions which are specifically derived, all the integral equations may have infinite or indeterminate solutions. The problems of sound radiation by a pulsating sphere is used to illustrate the solutions of all the different integral equations and to demonstrate the complications that occur at the characteristic wave numbers. Special and simple techniques are described for approximating each of the integral equations by a linear matrix equation with finite elements and for the numerical solution of the matrix equation. Special methods are described to eliminate the indeterminacy in the solution to the matrix equation near the characteristic wave numbers. Author (GRA)

N71-35864# Rensselaer Polytechnic Inst., Troy, N.Y. Mechanics Div.
ON THE INTERACTION OF THE ELECTROMAGNETIC FIELD WITH HEAT CONDUCTING DEFORMABLE INSULATORS
H. F. Tiersten and C. F. Tsai Jun. 1971 71 p refs
(Contract N00014-67-A-0117-0007)
(AD-726450; TR-5) Avail: NTIS CSCL 20/12

The differential equations and boundary conditions describing the behavior of a finitely deformable, polarizable and magnetizable, heat conducting continuum in interaction with the electromagnetic field are derived by means of a systematic application of the laws of continuum physics to a well-defined macroscopic model. The model consists of an electronic charge and spin continuum coupled to a lattice continuum, which in itself consists of two interpenetrating ionic continua, which can displace with respect to each other to produce ionic polarization. As spin angular momentum and electronic and ionic linear momentum are taken into account, magnetic spin resonance and both ionic and electronic polarization resonances are included in the treatment. Magnetic interaction terms are obtained by regarding magnetization as a consequence of point circulating current densities. When material resonances are suppressed, a simpler model is applicable and a not only smaller but somewhat different system of equations turns out to be convenient.
Author (GRA)

N71-35865 Oregon State Univ., Corvallis.
NUMERICAL METHODS FOR VARIABLE PERMEABILITY MAGNETOSTATIC FIELD PROBLEMS
Lee Roy Anderson (Ph.D. Thesis) 1970 172 p
Avail: Univ. Microfilms Order No. 70-19052

Solutions to the variable permeability magnetostatic field problems are achieved in both rectangular and cylindrical coordinates for a wide variety of magnet geometries. The resulting difference equations are solved iteratively and a method is provided which substantially increases the rate of convergence for these type of problems. Magnetization curves for several commonly used ferromagnetic alloys are spline-fit with low order polynomials up to seven orders of magnitude. The properties of these curves which affect the convergence of particular problems are investigated. In order to determine the accuracy of the computed results, comparisons are made with known analytic solutions in the linear case, and with measured field values in the non-linear case. Three computer programs which developed from this study are described. These programs are currently available for general use, and instructions for their use are given.
Dissert. Abstr.

N71-35866 Rutgers Univ., New Brunswick, N.J.
A NUCLEAR MAGNETIC RESONANCE STUDY OF THE TEMPERATURE AND DENSITY DEPENDENCE OF THE LOCAL MAGNETIC FIELD IN XENON GAS
Edward Kanegsberg (Ph.D. Thesis) 1970 123 p
Avail: Univ. Microfilms Order No. 70-16934

The free precession frequency was measured for Xe-129 at several densities of natural xenon gas ranging from 30 to 300 amagats (1 amagat = density at 0 C and 1 atm) and covering a temperature range of 2 to 180 C. Small amounts of oxygen are added to reduce the spin-lattice relaxation time of the samples and the frequencies are measured relative to the free precession frequency of protons in a water sample. Dissert. Abstr.

24 PHYSICS, ATOMIC, MOLECULAR, AND NUCLEAR

Includes atomic, molecular, and nuclear physics. For applications see: 22 Nuclear Engineering. For related information see also: 29 Space Radiation.

N71-35867# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy.
GRAPHS FOR STUDYING ISOTOPIC RELATIONS IN REACTIONS WITH PRODUCTION OF THREE PARTICLES AND POSSIBLE POMERANCHUK POLE EXCHANGE
O. V. Dumbrais 1971 12 p refs In RUSSIAN
(JINR-P2-5630) Avail: AEC Depository Libraries

Graphs are applied to the analysis of isotopic relations among cross sections for reactions with production of three particles and possible dominance of Pomeranchuk pole exchange at high energies. More experimental data are required to draw any general conclusions about the validity of this hypothesis.
Author (NSA)

N71-35868# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
DETERMINATION OF THE BREIT-WIGNER RESONANCE WIDTHS USING THE FOURIER ALGORITHM
V. M. Dubovik, B. L. Markovski, L. M. Soroko, and T. A. Strizh 1971 23 p refs In RUSSIAN; ENGLISH summary
(JINR-P2-5659) Avail: AEC Depository Libraries

It is shown that in general the widths can be found using the low frequency region only, where the Fourier transform of the Gauss shape has negligibly small amplitudes. Some model curves (in the absence of noise) illustrate the above-mentioned assertions. The case of an incoherent superposition of the B-W doublet components was investigated. The model curve, which is very close to those of the compound radioactive decay, shows that in the case when the noise is low enough the method is of an extensive use. If the noise level and the difference between Gamma sub 1 and Gamma sub 2 are sufficiently large, one can in practice select the short-lived component only. The influence of the cut-off effect and of the discrete character of the

experimental data on the results obtained by the method is considered. It is shown that in the presence of a high pedestal under the peaks the method is not suitable for direct applications. Author (NSA)

N71-35869# Comitato Nazionale per l'Energia Nucleare, Rome (Italy).
ANALYSIS OF METHODS FOR INTERPRETING BREMSSTRAHLUNG SPECTRA [ANALISI DEI METODI DI CORREZIONE DI SPETTRIX CONTINUI]
M. Pagsnini Fioratti and S. Ricci Piermattei 14 Sep. 1970 21 p refs In ITALIAN
(RT/FI-(70)36) Avail: AEC Depository Libraries

An analysis is made of the analytical methods for interpreting bremsstrahlung spectra. Owing to the nature of the response matrix, the iterative method is the most adequate one to obtain correct information. Author (NSA)

N71-35870# Comision Nacional de Energia Atomica, Buenos Aires (Argentina).
EXCITATION FUNCTIONS FOR THE NUCLEAR REACTIONS Tb-159(d,p)Tb-160 AND Tb-159(d,4n)Dy-157
L. Nicola Siri (Univ. Nacional de Buenos Aires, Argentina) and S. J. Nassiff 1970 9 p refs In SPANISH
(CNEA-283) Avail: AEC Depository Libraries

Excitation functions for the nuclear reactions (d,p) and (d,4n) on Tb-159 were determined by activation. The method of stacked metal foils was employed. The energy of the incident deuteron beam was 27.2 MeV. Author (NSA)

N71-35871# Institute of Nuclear Research, Warsaw (Poland).
CONNECTION OF THE RADIATIVE CAPTURE MECHANISM WITH THE STRUCTURE (A GREATER THAN 100)
Jan S. Brzosko 1971 72 p refs
(INR-1271) Avail: AEC Depository Libraries

The present paper is a summing up of investigations into the nature of anomalous amplification in gamma spectra accompanying nucleon radiative capture. The method and results are presented for measurements of gamma ray spectra in the reactions: (n,gamma): E sub n = 0.03 to 1.4 MeV, (p,gamma): E sub p = 4 MeV, and (gamma,gamma prime): E sub gamma = about 7 MeV for heavy nuclei (A > 100). The results, in units of cross section (with the exception of the (gamma,gamma prime) reaction), are compared with calculations based on the assumption of a direct process and the compound-nucleus model. Whereas in the direct process the measured values differ from the calculated values by three orders, in the case of the compound-nucleus model the agreement is good both quantitatively and qualitatively. This agreement is conditional upon account being taken of a resonance occurring in the probability of gamma ray emission at a gamma energy of about 6 to 8 MeV. Conclusions emerging from available experimental information about this resonance are discussed and substantiate the view that the anomalous bump in the gamma ray spectrum is associated with compound-nucleus decay. Author (NSA)

N71-35872# Lyon Univ. (France). Institut de Physique Nucleaire.
MEAN RECOIL, ISOMER RATIO, AND EXCITATION FUNCTIONS FOR REACTIONS INDUCED BY ALPHA PARTICLES IN RUBIDIUM [RECULS MOYENS, RAPPORTS ISOMERIQUES ET FONCTIONS D'EXCITATION POUR LES REACTIONS INDUITES PAR DES PARTICULES ALPHA SUR LE RUBIDIUM]
A. Demeyer, Noelle Chevarier, A. Chevarier, and Minh Duc Tran Dec. 1970 29 p refs In FRENCH; ENGLISH summary
(LYCEN-7091) Avail: AEC Depository Libraries

Excitation functions of reactions induced in Rb-85 by alpha particles are compared to those induced in Sr-88 by protons as a test of the independence hypothesis in the decay of the Y-89 compound nucleus. Mean-free-path measurements indicated the energy range valid for such a comparison. Information concerning the spin parameter was obtained from analysis of the isomer ratios. The shifted Fermi gas and superconductor models were tested. Author (NSA)

N71-35873# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
PROPERTIES OF LIGHT NUCLEI WITH REALISTIC N-N-INTERACTION
E. B. Balbutsev 1971 20 p refs In RUSSIAN
(JINR-P4-5614) Avail: AEC Depository Libraries

The Brueckner reaction matrix elements for the 2sld and 2plf shells are calculated using the Hamada-Johnston potential. An error is revealed in the corresponding calculations by Kuo and Brown. From it, a better agreement with experimental data is obtained in the calculations of the single-particle spectrum of O-17 and the binding energies of O-16 and Ca-40. The breathing energy levels of O-16 and Ca-40 are calculated. The isotope shifts for the O and Ca isotopes are calculated, taking the rearrangement effects into account. A good agreement with the experimental value is obtained for Ca-40 - Ca-42. Author (NSA)

N71-35874# Institute of Nuclear Techniques, Krakow (Poland).
TABLES OF MAGNETIC STRUCTURES DETERMINED BY NEUTRON DIFFRACTION. PART 2: TETRAGONAL SYSTEM [TABLICE STRUKTUR MAGNETYCZNYCH WYZNACZONYCH DYFRAKCJA NEUTRONOW]
A. Oles, A. Bombik, F. Kajzar, M. Kucab, and W. Sikora Nov. 1970 68 p refs
(NP-18783; INT-4) Avail: AEC Depository Libraries

Compounds and alloys belonging to the tetragonal system at room temperature are reported. The tables contain the chemical symbol of the substance, its space group, crystallographic data, cation distribution, temperatures of magnetic transitions, a brief description of magnetic structure including some figures, magnetic moments and their directions, effective magnetic moments, and references on magnetic additional properties. Magnetic space groups for stoichiometric compounds are indicated. Author (NSA)

N71-35875# Central Research Inst. for Physics, Budapest (Hungary).
DETERMINATION OF NEUTRON SPECTRA FROM ACTIVATION DATA BY MEANS OF RF01 AND RF07 CODES
L. Turi and A. Fisher [1971] 18 p refs In RUSSIAN; ENGLISH summary
(KFKI-70-30-RPT) Avail: AEC Depository Libraries

Program RF01 can be used only for the case of threshold detectors. Program RF07 has no such restrictions. By using proper foils, the spectrum in the whole energy range of reactors can be determined simultaneously. The algorithm of the methods and input/output specifications of the codes are given. Author (NSA)

N71-35876# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Neutronenphysik und Reaktortechnik.
TREATMENT OF SPACE DEPENDENCE OF THE ENERGETIC RESONANCE SELF SHIELDING AT BOUNDARIES OF HOMOGENEOUS ZONES IN REACTORS [DIE BEHANDLUNG DER ORTSABHAENGIGKEIT DER ENERGETISCHEN RESONANZSELBSTABSCHIRMUNG AN GRENZFLAECHEN HOMOGENER ZONE IN REAKTOREN]
H. Huschke (Ph.D. Thesis - Karlsruhe Univ.) Jan. 1971 117 p refs In GERMAN; ENGLISH summary
(KFK-1383) Avail: AEC Depository Libraries

The problem of space dependent resonance self shielding at boundaries is investigated for the case of two half spaces with different concentration of a resonant material. A formalism is developed which allows a description of this phenomenon, also at boundaries of narrow zones by using the f-factor tables of the existing Karlsruhe group cross section sets. For two assemblies

the influence of space dependent resonance self shielding on important reactor parameters is investigated. Author (NSA)

N71-35877# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Radiochemie.
PRODUCTION OF NEUTRONS THROUGH IRRADIATION OF THICK BERYLLIUM TARGETS WITH DEUTERONS IN THE ENERGY RANGE FROM 15 TO 55 MeV [ERZEUGUNG VON NEUTRONEN DURCH BESTRAHLUNG DICKER BERYLLIUMTARGETS MIT DEUTERONEN IM ENERGIEBEREICH VON 15 BIS 55 MeV]
K. Schmidt and H. Muenzel Sep. 1970 20 p refs In GERMAN; ENGLISH summary
(KFK-1288) Avail: AEC Depository Libraries

The angular and energy distributions of neutrons produced by bombarding thick beryllium targets with 53.8-MeV deuterons are studied. A procedure is described whereby neutron spectra for deuteron energies between 15 and 55 MeV may be determined and the geometrical factors necessary for the determination of the induced activity in irradiated samples may be calculated. Author (NSA)

N71-35878*# Perkin-Elmer Corp., Pomona, Calif.
QUADRUPOLE ION ENTRANCE MASK STUDY Interim Report, Apr. 1971
N. Lerokomos and M. R. Ruecker Apr. 1971 74 p
(Contract NAS5-11185)
(NASA-CR-121905) Avail: NTIS CSCL 20H

Theoretical and computer analyses of the unstable ions in a quadrupole mass spectrometer are reported. The use of ion source masking to eliminate penetrating unstable ions is covered. The test results of ion source nozzle masking with the associated decrease in peak tails are also included. Author

N71-35879# Aktiebolaget Atomenergi, Studsvik (Sweden).
GENERAL PHYSICS SECTION Progress Report, Fiscal Year 1969 - 1970
J. Braun Dec. 1970 91 p refs
(AE-410) Avail: AEC Depository Libraries

Experiments with isotopic, mainly tritium, batteries are described. Commercially available solar cells and surface-barrier detectors were used for alpha and beta voltaic conversion. Instability effects in a MHD channel and work on the electron-ion recombination problem for helium at high pressure are reviewed. Experiments concerning the helium afterglow MHD scheme and pure noble gas MHD are described. A system for recombination measurements with a discharge chamber made of glass is discussed. Results from investigations at lower pressures than 75 torr performed with quenching techniques are summarized. Fast neutron, helium production, cross section measurements, a boron analysis method, and development work on helium accumulating dosimeters for high neutron fluences and long irradiation times are briefly reviewed. J.A.M.

N71-35880# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy.
APPLICATION OF THE PHENOMENOLOGICAL QUASI-TWO-BODY MODEL TO PION(MINUS) PROTON-INTERACTIONS WITH THE STRANGE PARTICLE PRODUCTION AT p EQUALS 4 GeV/c
V. G. Grishin, Sh. V. Inogamov, A. A. Kuznetsov, N. N. Melnikova, A. Mikhul et al 1971 24 p refs In RUSSIAN
(JINR-P1-5706) Avail: AEC Depository Libraries

It is shown that the main features of pion(minus) proton interactions with the strange particle production at p = 4 GeV/c can be described in the framework of the phenomenological quasi-two-body model of multiple particle production. Author (NSA)

N71-35881# Academy of Sciences (USSR), Moscow.
STUDIES OF ANALOG STATES OF T EQUALS 2 IN Mg-26(He-3,n)Si-28, Ti-46(He-3,n)Cr-48, AND Ni-58(He-3,n) Zn-60 REACTIONS
O. D. Brill, A. D. Vongai, V. S. Romanon, and A. R. Faiziev 1970 16 p refs In RUSSIAN
(IAE-1958) Avail: AEC Depository Libraries

During the reaction (He-3,n) on Mg-26, Ti-46, and Ni-58 intense excitation was observed of lower T = 2 states in Si-28, Cr-48, and Zn-60 at 15.27 + or - 0.07, 8.77 + or - 0.05, and 7.39 + or - 0.125 MeV, respectively. NSA

N71-35882# Comision Nacional de Energia Atomica, Buenos Aires (Argentina).
RESONANCE INTEGRALS FOR NEUTRON ACTIVATION OF Zn-64, Zn-68, Rb-85, Mo-100, Ru-102, In-113, Sb-123, AND Hf-180 [INTEGRALES DE RESONANCIA DE ACTIVACION DE NEUTRONES DE: ZN-64, ZN-68, RB-85, MO-100, RU-102, IN-113, SB-123, Y HI-180]
M. D. Ricabarra, R. Turjanski, and G. H. Ricabarra 1970 17 p refs In SPANISH; ENGLISH summary
(CNEA-282) Avail: AEC Depository Libraries

The ratio of resonance integral to thermal activation cross section of the isotopes Zn-64, Zn-68, Rb-85, Mo-100, Ru-102 In-113, Sb-123, and Hf-180 relative to gold was determined by measuring cadmium ratios. The standard gold or a secondary standard was mixed uniformly in the samples, and the activities were resolved with a lithium-drifted germanium gamma-ray spectrometer. All measurements are relative to s sub 0 = 17.7 for gold. Author (NSA)

N71-35883# European Organization for Nuclear Research, Geneva (Switzerland).
COMPILATION OF CROSS SECTIONS. 6: NEGATIVE PION INDUCED REACTIONS
E. Flaminio (Pisa Univ.), J. D. Hansen, D. R. O. Morrison, and N. Tovey 23 Oct. 1970 172 p refs
(CERN/HERA-70-7) Avail: AEC Depository Libraries

A compilation of cross sections of reactions produced by negative pions on targets of protons, neutrons and deuterons is presented. Graphs of the variation of cross section with incident laboratory momentum are plotted. Values for the rate of decrease of cross section with incident momentum are given. Author (NSA)

N71-35884# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Moscow (USSR). Inst. Teoreticheskoi i Eksperimentalnoi Fiziki.
INVARIANTS OF THE ROTATION GROUP
M. S. Marinov and V. I. Roginskii 1970 39 p refs In RUSSIAN
(ITEF-782) Avail: AEC Depository Libraries

Any quantity transforming under an irreducible representation of the space rotation group may be realized in three forms: as a multispinor; as a 3-tensor or tensor-spinor; or as an I-spinor. Only one invariant may be constructed of three quantities of a given type; so the three invariants are equal up to a numerical factor that is found in the work. A number of invariants may be constructed of four quantities, not all of them independent. For applications it is of importance to be able to construct an independent set of invariants of every type, as well as to relate the invariants of different types. This problem is solved for arbitrary angular momenta 1 sub 1, 1 sub 2, 1 sub 3, 1 sub 4. Author (NSA)

N71-35885# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions.
METHOD OF CALCULATING THE UNITARY WEIGHTS IN THE THEORY OF MULTIPLE PARTICLE PRODUCTION
V. S. Barashenkov and Kh. M. Beshtoev 1971 7 p refs In RUSSIAN
(JINR-P2-5729) Avail: AEC Depository Libraries

A method of calculating the weights more simple than that discussed previously is suggested. Author (NSA)

N71-35886# Japan Atomic Energy Research Inst., Tokyo.
MULTI-GROUP CONSTANTS FOR FISSION PRODUCT NUCLIDES
Tatsuzo Tone and Akira Hasegawa Dec. 1970 208 p refs In JAPANESE; ENGLISH summary
(JAERI-Memo-4251) Avail: AEC Depository Libraries

Many sets of multi-group constants of (n,gamma) reactions for fission products have been produced on the basis of several data sources. Energy ranges covered are 10 MeV to 0.215 eV and 10 MeV to 1 keV. Some typical cross sections and yields including the recent data were reviewed and adopted. The fissionable nuclides covered are Pu-239, U-235, and U-238 for fast-neutron fission and Pu-239, U-235 and Pu-241 for thermal-neutronfission. Author (NSA)

N71-35887# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.
X-RAY SPECTROMETER WITH COOLED Si(Li)-DETECTOR
R. D. Arlt, A. E. Benifatov, A. I. Kalinin, M. M. Pertrov, and L. I. Tyvin 1971 8 p refs In RUSSIAN
(JINR-P13-5707) Avail: AEC Depository Libraries

The X-ray spectrometer using a Si(Li)-detector and field transistor placed in a chamber-cryostat are described. A resolution of 850 eV was obtained on a 6.4 keV line from Co-57. Author (NSA)

N71-35888# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
POSSIBLE METHOD OF MEASURING THE ELECTROMAGNETIC FORM FACTOR OF THE NEUTRINO
V. I. Andryushin, S. M. Bilenkii, and S. S. Gerstein 1971 10 p refs In RUSSIAN
(JINR-P2-5705) Avail: AEC Depository Libraries

A possible method of determining the electromagnetic form factor of neutrino is considered. The method is based on the comparison of the cross sections of the processes induced by electromagnetic interaction of neutrinos and electrons with the nuclei. The calculation of the cross section of excitation of the giant resonance by the neutrino beam is presented as well as the nucleus fission cross sections. Author (NSA)

N71-35889# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.
NUCLEON COMPTON EFFECT AND SUM RULE FOR DIPOLE NUCLEON MOMENT
L. I. Lapidus and M. M. Musakhanov 1971 21 p refs In RUSSIAN
(JINR-P2-5679) Avail: AEC Depository Libraries

The sum rule for the nucleon dipole moment is obtained with the help of the dispersion relation and low energy theorem for the nucleon Compton effect amplitude without P- and T-invariance conditions. In the general expression for nucleon Compton effect amplitude, the invariant functions corresponding to P-invariance violation violate PT-invariance. For forward scattering relations and between invariant functions, spiral amplitudes with absolute value of (m prime -m) greater than or equal to 2 are considered. NSA

N71-35890# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy.
INVARIANCE OF THE NONRELATIVISTIC WAVE EQUATIONS IN THE PRESENCE OF ELECTROMAGNETIC FIELD
V. N. Streltsov 1970 9 p refs In RUSSIAN
(JINR-P2-5522) Avail: AEC Depository Libraries

The problems of the nonrelativistic wave equation invariance for particles with spins 0 and 1/2 in electromagnetic field are discussed. Author (NSA)

N71-35891# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy.
INTERFERENCE PHENOMENA IN THE SYSTEM OF TWO RESONANCES
G. I. Kopylov and M. I. Podgoretskii 1971 20 p refs In RUSSIAN
(JINR-P1-5668) Avail: AEC Depository Libraries

The interference phenomena are considered appearing in the case when among the products of two decaying resonances there are identical particles with close velocities. These effects allow the difference of the resonance lifetimes to be directly measured. Author (NSA)

N71-35892# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
RELATIVISTIC WAVE FUNCTION AND FORM FACTORS SPACE OF RELATIVE MOMENTA
R. N. Faustov 1971 20 p refs In RUSSIAN
(JINR-P2-5691) Avail: AEC Depository Libraries

The possibility of constructing a quantum field theory in which the relative four-moments belong to four-space of constant curvature and the total four-momentum possesses all the usual properties and obeys the standard conservation law is discussed. The inverse radius of curvature of the relative momentum space plays the role of the fundamental length. Author (NSA)

N71-35893# Tokyo Univ. (Japan). Inst. for Nuclear Study.
NEGATIVE PION PHOTOPRODUCTION OFF NEUTRON AT 180 DEG IN THE ENERGY RANGE BETWEEN 300 AND 1200 MeV
Fumihiko Takasaki 20 Jan. 1971 37 p refs
(INSJ-128) Avail: AEC Depository Libraries

Differential cross sections for gamma + n yields pion(-) + p were measured at 180 deg for the energy range between 300 and 1200 MeV. A magnetic spectrometer system was used to detect pion(-) mesons produced in a liquid deuterium. In order to reduce the energy spread due to the internal nucleon motion in the deuteron, a photon difference method was employed with a step of 50 MeV. The data show large peaks at 730 and 950 MeV. An analysis was made for these resonance structures together with the cross sections for gamma + p yield pion(+) + n at the same region, which were obtained in another part of this experiment. A clear effect of (S11)(1525) was concluded with the substantial difference of the excitation amplitude between two reactions (D13)(1515) and (F15)(1690) also have small but finite contributions to the helicity 1/2 state. Photoexcitation amplitudes of resonances are in good agreements with quark model predictions. Author (NSA)

N71-35894# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy.
POSSIBILITIES OF THE RESONANCE INTERFEROMETRY
G. I. Kopylov 1971 26 p refs In RUSSIAN
(JINR-P1-5666) Avail: AEC Depository Libraries

When two identical particles are produced in the resonance particle system, it is possible to measure the resonance width in a device of the missing-mass spectrometer type by recording identical particles only. An artificial broadening of resonance peaks can be observed in such an interferometer of resonances, making possible the measurement of narrow (on the order of several MeV) resonance widths. Author (NSA)

N71-35895# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.
CALCULATION AND GENERATION OF THE MAGNETIC SYSTEM OF THE MONOENERGETIC CYCLOTRON
S. B. Vorozhtsov and N. L. Zaplatin 1971 10 p refs In RUSSIAN
(JINR-P9-5669) Avail: AEC Depository Libraries

The stages of formation of the magnetic field in the model of the accelerator sector electromagnet on a 1:10 scale are given. The configuration of the magnetic circuit was chosen in the process of calculations and experiments. Author (NSA)

N71-35896# Institute of Nuclear Research, Warsaw (Poland).
FLANGE-AL 4 CODE FOR THE GIER COMPUTER [KOD FLANGE-AL4 NA MASZYNE, CYFROWA, GIER]
J. Arkuszewski, W. Baran, and K. Kowalska 1971 36 p In POLISH
(INR-1260) Avail: AEC Depository Libraries

FLANGE-Al 4 is an ALGOL 4 program for calculation of the scattering kernels and scattering cross sections of polycrystalline moderators. The scattering law was previously calculated and put on the magnetic tape by the MINIGASKET code. The program is based on the algorithm of the FLANGE code written in FORTRAN. Author (NSA)

N71-35897# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.
OPTO-ELECTRONIC LINK FOR TRANSMITTING TEMPORAL INFORMATION
R. Odru and J. Vacher Feb. 1971 8 p In FRENCH
(CEA-N-1431) Avail: AEC Depository Libraries

An opto-electronic link was effected between an electroluminescent diode and a fast photomultiplier. The combination allows the temporal information associated with time of flight measurements to be obtained in the vicinity of an electrostatic accelerator where very large potential differences exist (approximately equal to 250 kV). Fluctuations in transit time introduced by the link are less than 0.5 ns and the consequent counting losses are very small up to 5 MHz. Author (NSA)

N71-35898# Lyon Univ. (France). Inst. de Physique Nucleaire.
REACTIONS INDUCED IN GOLD BY DEUTERONS WITH ENERGIES BETWEEN 10 AND 70 MeV
Noelle Chevarier, A. Chevarier, A. Demeyer, and Minh Duc Tran 23 Dec. 1970 22 p refs In FRENCH
(LYCEN-7092) Avail: AEC Depository Libraries

Excitation functions were determined for reactions induced in gold by deuterons with energies up to 70 MeV. Isomer ratios were measured for (d,2n), (d,4n), and (d,p2n) reactions. The (d,xn) excitation functions are interpreted using a statistical model which includes evaporation and precompound emission. The Huizenga-Vandenbosch calculation gives good agreement for isomer ratios with (d,2n) and (d,4n) reactions in the energy range corresponding to compound-nucleus processes. It is shown that, with respect to its isomer ratio and its excitation function, the (d,p2n) reaction is dominantly a transfer reaction. Author (NSA)

N71-35899*# National Bureau of Standards, Washington, D.C.
PENETRATION OF HIGH ENERGY RADIATION
1 Sep. 1971 5 p
(NASA Order R-09-022-011)
(NASA-CR-119939) Avail: NTIS CSCL 20H

A set of computer programs for calculating the penetration and diffusion of electrons and associated bremsstrahlung through extended media was developed. A brief summary of the programs and their applications is presented with a list of publications. J.M.

N71-35900*# Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics.
PHYSICAL ELECTRONICS AND SURFACE PHYSICS
Quarterly Progress Report
15 Jul. 1971 18 p refs
(Grant NGR-22-009-091; Contract DA-28-043-AMC-02536(E))
(NASA-CR-121985; QPR-102) Avail: NTIS CSCL 20H

Results are presented graphically of investigations of the diffraction of helium beam from a clean tungsten (112) crystal surface. This was reportedly the first instance of atomic diffraction from a pure metal surface. Also described are experimental investigations of the spatial and speed distributions of deuterium molecules desorbed from polycrystalline and single crystal (110) nickel surfaces. A quantitative method is described for characterizing the data by taking low order moments of the time-of-flight curves. A.L.

N71-35901*# Techtran Corp., Glen Burnie, Md.
THE PROBLEM OF THE GENERATION OF PARTICLES IN THE CLASSICAL MECHANICS [PROBLEMA ROZHDENIYA CHASTITS V KLASSICHESKOY MEKHANIKE]
Yu. A. Rylov Washington NASA [1971] 18 p refs Transl. into ENGLISH from Russian report Pr-21
(Contract NASw-2037)
(NASA-TT-F-13736) Avail: NTIS CSCL 20H

The phenomenon of generation of particles is described in terms of classical relativistic mechanics. A classical generating pairs field was introduced. This field is shown to be treated as a classical equivalent of a certain quantum field. The limit transition from the quantum mechanics to the classical one corresponds to the disappearance of the classical field conserving the phenomenon of generation of particles. A method of receiving quantum relativistic equations is described. Author

N71-35902# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
CONFIGURATION AND MIGRATION OF POINT DEFECTS IN ALKALI METALS [CONFIGURATION ET DEPLACEMENT DE DEFAUTS PONCTUELS DANS LES METAUX ALCALINS]
Ian M. Torrens and Maurice Gerl Oct. 1969 24 p refs In FRENCH
(CEA-R-3849) Avail: AEC Depository Libraries

A computer calculation of vacancy and interstitial migration using a pair-interaction potential deduced from the theory of pseudopotentials is described. The parameters involved in the expression of the potential are adjusted so as to reproduce the elastic constants and the phonon spectrum of the perfect crystal. One obtains the relaxation energies at equilibrium configuration and at the saddle point and the migration energy of a vacancy and an interstitial in the alkali metals. For Na, K, and Rb, the vacancy mechanism is the most probable whereas in Li, there is a possibility of an interstitial mechanism, which would explain the experimental results. The diffusion of alkali solutes in alkali metals is analyzed by means of a pair-interaction potential deduced from the physical properties of the pure solvent and solute crystal. For solute atoms bigger than the solvent, the substitutional mechanism explains the experimental results whereas an interstitial mechanism is more probable for small impurities. Author (NSA)

N71-35903# Australian National Univ., Canberra. Dept. of Nuclear Physics.
SOME NOTES ON PARTICLE IDENTIFICATION USING THE ORTEC 423 IDENTIFIER
J. B. A. England [1970] 25 p refs
(ANU-P-514) Avail: AEC Depository Libraries

A guide to preparation of a particle identification system using the ORTEC 423 is given. Typical block diagrams of circuits are given with recommended settings. A section is included on the selection, operation and performance of thin delta E detectors. A selection of graphs that are generally required for particle identification experiments is included together with theoretical performance graphs for the 423 for the typical ranges of particle types and energies encountered in the ANU laboratory. NSA

N71-35904# Australian National Univ., Canberra. Dept. of Nuclear Physics.
SANDRA: THE DWBA CODES JULIE AND DWUCK ADAPTED FOR USE ON THE IBM 360/50 COMPUTER
P. J. Dallimore and J. R. Davis [1971] 16 p refs
(ANU-P-507) Avail: AEC Depository Libraries

The distorted wave Born approximation codes JULIE and DWUCK were adapted for use on the IBM 360/50 computer. Minor modifications were made to the program (for example, the ability to read in angles in either the center of mass or laboratory coordinate systems), but the mathematical techniques were left unchanged. Author (NSA)

N71-35905# Lund Univ. (Sweden). Dept. of Physics.
ANNLIS: A COMPUTER PROGRAM FOR THE AUTOMATIC ANALYSIS OF GAMMA-RAY SPECTRA
P. Ekstroem, I. Mauritzson, and J. Tillman Jan. 1971 66 p refs
(LUNP-7101) Avail: AEC Depository Libraries

A FORTRAN 5 code, written for a UNIVAC 1108 computer, for the analysis of gamma-ray spectra from Ge(Li)-detectors is described. The program ANNLIS, automatically locates all peaks in a read-in spectrum, and determines their energies and intensities. Composite peaks are not resolved by the program. The result can be visually checked on a plot from a fast printer.
Author (NSA)

N71-35906# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
STUDY OF SOME PROPERTIES OF BOUND LEVELS AND VIRTUAL LEVELS EXCITED WITH RESONANCE NEUTRONS [ETUDE DE QUELQUES PROPRIETES DE NIVEAUX LIES ET DE NIVEAUX VIRTUELS EXCITES A L'AIDE DE NEUTRONS DE RESONANCE]
Rex Nazare Alves (Ph.D. Thesis - Paris Univ.) 1969 402 p refs In FRENCH
(CEA-R-3602) Avail: AEC Depository Libraries

Many neutron resonance parameters of some nuclei are determined to find the strength function S sub 0 with accuracy. For those nuclei, the S sub 0 value seems not to depend on the spin value J = 1 or 2 but may depend on neutron energy for Au-197. Total radiative width variation against mass number A and spacing distributions between resonances (for Au-197) are studied and discussed. Analytical methods for neutron capture experiments are described, and level schemes of Cl, Mn, Fe, Co, Cu, Tm, Hg are presented along with spin values. Intensities of E sub 1 and M sub 1 transitions with direct capture and interference effects are discussed in view of experimental results.
Author (NSA)

N71-35907# Japan Atomic Energy Research Inst., Tokyo.
DYNAMIC MOLECULAR ORBITALS AND THEIR APPLICATION TO CHARGE EXCHANGE REACTIONS
Hiroshi Ryufuku Jan. 1971 24 p refs In JAPANESE; ENGLISH summary
(JAERI-Memo-4299) Avail: AEC Depository Libraries

Expressions for the resonance and nonresonance charge-exchange probabilities applicable in collisions between atomic systems are derived theoretically. This is accomplished by means of the PSS method together with dynamic molecular orbitals. It is shown that in the low energy limit the present expressions agree with the result derived by the common PSS method and in the high energy limit with Brinkman and Kramers' formulation using the Born approximation.
Author (NSA)

N71-35908# Tokyo Univ. (Japan). Inst. for Nuclear Study.
OPERATION CHARACTERISTICS OF THE 75 cm HYDROGEN BUBBLE CHAMBER AND THE REFRIGERATOR. 1.
H. Hirabayashi, N. Ishihara, I. Kita, M. Tsino, and H. Tateno Jan. 1971 22 p refs In JAPANESE; ENGLISH summary
(SJC-T-71-1) Avail: AEC Depository Libraries

A liquid hydrogen bubble chamber and refrigerator were constructed and test operations were carried out three times during the test run time from December 1969 to October 1970. The first run confirmed that the refrigerator, which is the simple Linde type, could afford about 60 liters of liquid hydrogen per hour, or the refrigerating power of about 1000 watts at 25 K. In the later two runs, the bubble chamber was cooled down to about 23 K at the rate of less then 5 K per hour and was filled up with 220 liters of liquid hydrogen. With expansions of about 0.75% of the total liquid volume, which was kept at the temperature of 26.0 K, and a pressure of 5.0 kg/sq cm the tracks of cosmic rays and Compton electrons from cobalt 60 were seen and photographed.
Author (NSA)

N71-35909# Institute of Nuclear Research, Warsaw (Poland).
CLASSICAL THEORY OF ATOMIC COLLISIONS. 2: ELASTIC ATOMIC COLLISIONS
Michal Gryzinski 1970 132 p refs In POLISH; ENGLISH summary
(INR-P-1217) Avail: AEC Depository Libraries

A method for describing elastic atomic collisions is given. General considerations on scattering resulting from the existence in interacting objects of multipole moments of different order, both constant and varying in time, are presented. The exponential decrease of interaction effectiveness is the characteristic feature of dynamic systems. The Ramsauer effect is connected with the dynamic nature of the atomic shell, while the intermolecular forces (van der Waals forces) are determined primarily by the time-averaged multipole moments characteristic of an external atomic shell. The basic multipole moments of some atoms and molecules are determined. Basic shell frequencies are calculated. The classical theory of scattering, when combined with the classical theory of the atom, permits a quantitative analysis of a wide variety of physical phenomena.
Author (NSA)

N71-35910# Atomic Energy Establishment, Winfrith (England).
LOW GAMMA-SENSITIVITY BORON PROPORTIONAL COUNTER
F. H. Allen Oct. 1970 20 p refs
(AEEW-M-970) Avail: AEC Depository Libraries

The design, construction, and development of a 9/32 inch diameter boron proportional counter, with a thermal neutron sensitivity of approximately 0.00003 c/s per unit flux are described. The counter was designed to have a low sensitivity to gamma radiation and to withstand an operating temperature of 200 C.
Author (NSA)

N71-35911# Central Electricity Generating Board, Berkeley (England). Nuclear Labs.
EFFECTS OF HIGH FLUX NEUTRON IRRADIATION ON THE MICROSTRUCTURE OF METALS
S. B. Fisher and K. R. Williams Dec. 1970 24 p refs
(RD/B/N-1812; FRDC/FEWP/P-(70)559) Avail: AEC Depository Libraries

The fast reactor development sequence involves an increase in fast neutron flux. The consequences of such an increase on the microstructure of cladding material are discussed as far as is possible with available data from in-reactor and high-voltage electron microscope studies.
Author (NSA)

N71-35912# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Serpukhov (USSR). Institut Fiziki Vysokikh Energii.
SEARCH FOR PARTICLES WITH A FRACTIONAL CHARGE (QUARKS) IN THE 70 GeV ACCELERATOR
Yu. M. Antipov et al 1971 17 p refs Transl. into ENGLISH from RUSSIAN report
(CERN-Trans-71-4; IFVE-68-72) Avail: AEC Depository Libraries

An experimental search for quarks produced by protons at an energy of 70 GeV on an internal aluminum target is described. Measurements were made on a 50-GeV/sec beam of negative particles extracted from the accelerator at an angle of 0 deg. Upper limits for the differential and total cross sections for quark production are given.
Author (NSA)

N71-35913# Commissariat a l'Energie Atomique, Bruyeres-Le-Chatel (France).
APPLICATION OF ATOMIC ABSORPTION SPECTROPHOTOMETRY TO THE RAPID ANALYSIS OF SOME ELEMENTS IN URANIUM
Michel Bufferaau and Jacques Robichet Dec. 1969 39 p refs In FRENCH
(CEA-R-3870) Avail: AEC Depository Libraries

After a brief review of the main conditions for analysis for

impurities in uranium, characteristics of the sample solution and analytical conditions in presence of uranium were studied. Some interferences are shown and comparative results are given. Limits of application of the method are discussed. Author (NSA)

N71-35914# Tokyo Univ. (Japan). Inst. for Nuclear Study.
MUTRON PROJECT (PROPOSAL)
Jul. 1970 86 p refs
(SJC-P-70-4) Avail: AEC Depository Libraries

The purposes of the Mutron project are to investigate the whole processes concerning muons in the energy range from 0.1 to 1 TeV, to confirm anomalous interactions and the qualitative aspects of the interaction between muons and nuclei, and to measure the energy spectrum and the charge ratio of muons. The instrument is composed of a solid iron magnet, a pair-transition meter and a wire spark chamber. Solid angle area is 1 sq m st. for the magnet, and 10 to 30 sq m st. for the others. The energy of muons is measurable up to 3 TeV with the magnet, and up to 100 TeV with the pair meter. The production angle of secondary particles and the energy in muon interaction process are measured with the transition meter (so called calorimeter), and the scattering of muons is observed with the wire spark chamber. It is expected that the anomaly of muons is observable in the TeV region by this project. NSA

N71-35915# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
POSSIBILITY OF GAS FLOW MEASUREMENTS USING IONIZATION PRODUCED BY RADIOACTIVE SOURCES: PERFORMANCE OBTAINED USING CONTINUOUS AND PULSED IONIZATION
Bruno Toudoire (Ph.D. Thesis - Paris Univ., Orsay, France) 1969 165 p refs In FRENCH
(CEA-R-3899) Avail: AEC Depository Libraries

Two methods for measuring gas flow were studied, based on the ionization of the fluid by a radioactive source. The continuous method utilized the relationship between the flow and the ionic density at a point situated downstream from the ionizing source. The pulsed method measured the time for a burst of ions to pass between two points in the circuit. An attempt was made to predict and to justify theoretically the experimental results, and to determine to what extent the methods can provide absolute measurements. These methods are characterized by the absence of moving parts or of parts under reduced pressure and can yield results with an accuracy of between a few per cent to a few tenths of a per cent. The information, provided in either analog or digital form, can be adapted for use in servomechanisms or automatic systems. Two applications of an industrial type are described; they concern gas-flow measurements in a railway braking circuit, and in tubes of 20 and 30 cm diameter. Author (NSA)

N71-35916# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
PARTIAL-WAVE ANALYSIS OF PION-NUCLEON ELASTIC SCATTERING BELOW 16 GeV [ANALYSE EN ONDES PARTIELLES DE LA DIFFUSION ELASTIQUE MESON PION-NUCLEON AU-DESSOUS DE 1,6 GeV]
Pierre Bareyre (Ph.D. Thesis - Paris Univ., 1968) 1969 83 p refs In FRENCH
(CEA-R-3578) Avail: AEC Depository Libraries

Experimental results of pion-nucleon elastic scattering below 1.6 GeV (total cross sections, angular distributions of elastic scattering and recoil nucleon polarizations) are described by a partial wave analysis. This analysis was developed, one energy at a time, with a method of least squares fits. A single solution is extracted by continuity with energy of the different solutions. Resonating behavior is clearly established for several partial waves. In addition to these important effects, some phase shifts show rapid variations with energy. Author (NSA)

N71-35917# Akademiya Nauk URSR, Kiev. Institut Teoreticheskoi Fiziki.
MODIFIED WKB METHOD, 2
Yu. L. Mentkovskii 1970 8 p refs In RUSSIAN; ENGLISH summary
(ITF-70-84-P) Avail: AEC Depository Libraries

A simple method of constructing the absolutely convergent modified WKB, expansions which are free of complicated matrix calculations is suggested. Author (NSA)

N71-35918# Akademiya Nauk URSR, Kiev. Institut Teoreticheskoi Fiziki.
DIMENSIONS AND FORM OF THE LIGHT NUCLEI WITH THE SURPLUS OF NEUTRONS
A. I. Steshenko and G. F. Filippov 1970 23 p refs
(ITF-70-83-E) Avail: AEC Depository Libraries

The dimensions and shape of light nuclei with a surplus of neutrons are calculated by the variational method on the one-particle wave functions of the three-dimensional anisotropic harmonic oscillator. The position of the boundary of stability for these nuclei is also estimated. Author (NSA)

N71-35919# College de France, Paris. Laboratoire de Physique Atomique et Moleculaire.
LOCAL MODELS FOR ANTIKAON-NUCLEON COLLISIONS [MODELES LOCAUX POUR LES COLLISIONS ANTIKAON-NUCLEON]
M. Benayoun and Ph. Leruste Feb. 1971 42 p refs In FRENCH; ENGLISH summary
(PAM-70-1) Avail: AEC Depository Libraries

A local model built from the D/D formalism and valid in the neighborhood of the antikaon-nucleon threshold is deduced. Since the local analysis of this process involves zero and one total isospin states, models for two or three channels are given, and the equivalence between this D/D local model and the Dalitz-Tuan one is proved. The conclusions given turn out to be of the same kind as those previously deduced from the analysis of the rational approximation; these conclusions are the same as those of Dalitz deduced by a nonrelated method. Concerning the coupling constant of the Y sub 0 (1405) resonance, the nature of the resonances is still unknown and the question is still unsolved as to whether the poles are of T- or K-matrix. NSA

N71-35920# Paris Univ., Orsay (France). Laboratoire de l'Accelerateur Lineaire.
DEVICE FOR MEASURING THE LUMINOSITY OF THE ORSAY STORAGE RING [DISPOSITIF DE MESURE DE LA LUMINOSITE POUR L'ANNEAU DE COLLISIONS D'ORSAY]
J. E. Augustin, J. Buon, J. Haissinski, D. Lalanne, P. Marin et al Apr. 1971 28 p refs In FRENCH; ENGLISH summary
(LAL-1249) Avail: AEC Depository Libraries

A precise monitoring device for the luminosity is used at the Orsay e(+)e(-) storage ring (ACO). Two lead-scintillator sandwich counters detect the photons emitted at small angles in the double bremsstrahlung reaction e(+)e(-) yields e(-)e(+) gamma gamma. The detection thresholds of these two counters are accurately determined by a tagging method of the bremsstrahlung photons. Author (NSA)

N71-35921# Paris Univ., Orsay (France). Laboratoire de l'Accelerateur Lineaire.
STUDY OF THE B-11 NUCLEUS BY ELECTRON SCATTERING [ETUDE DU NOYAU B-11 PAR DIFFUSION D'ELECTRONS]
R. Riskalla (Ph.D. Thesis) Feb. 1971 103 p refs In FRENCH
(LAL-1243) Avail: AEC Depository Libraries

The scattering of electrons by a natural boron target (80.22% B-11 and 19.78% B-10) was studied. The details concerning the handling of the experimental data are given (cross section calculations, shift of the elastic peak, physical corrections, counting losses, error, and the determination of

longitudinal and transverse components of the form factor). The energy spectra of electrons scattered by B-11 were measured for incident energies between 100 and 300 MeV and for angles between 30 and 135 deg. A spectroscopic analysis was made of the B-11 levels at excitation energies of 2.13, 4.46, 6.76, and 8.57 MeV. The fact that the ground state and the 4.46 and 6.76 MeV levels form a rotational band indicates the rotational or collective nature of the B-11 nucleus. In addition, the fact that the configuration of the individual particle agrees to some extent with the experimental points of the first excited state indicates the special nature of this transition. These two facts confirm the validity of hypotheses of the unified model. NSA

N71-38922# Bordeaux Univ. (France). Faculte des Sciences.
STUDY OF THE SPALLATION OF MEDIUM MASS NUCLEI [CONTRIBUTION A L'ETUDE DE LA SPALLATION DES NOYAUX DE MASSE MOYENNE]
Serge Regnier (Ph.D. Thesis) 1971 38 p refs In FRENCH
(NP-18820) Avail: AEC Depository Libraries

The cross sections for the production of Al-26 in Fe and Si by 600 MeV and 24 GeV protons were measured. The cross sections obtained in Fe and Si were, respectively, 0.36 + or - 0.07 mb and 11.1 + or - 1.1 mb at 600 MeV, and 2.3 + or - 0.5 mb and 6 + or - 1.2 mb at 24 GeV. The spallation cross sections were computed using a two-stage model. The evaporation stage was calculated using the RUDSTAM analytical method, and a simple approximation method was used to calculate the internuclear cascade. The principal characteristics of spallation for targets of medium mass was found. It is shown that these calculations explain the variations in the spallation cross sections with the charge and the mass of the products, the target, and the energy of the incident protons. The relative rates of production of spallation residues in Fe and Cu, and the dependence of the variations in the cross sections of Na-22, Na-24, and P-32 with the charge of the target were computed. The results obtained are fairly consistent with experiment. NSA

N71-38923# Paris Univ., Orsay (France). Faculte des Sciences.
PROBABILITIES OF ELECTROMAGNETIC TRANSITIONS IN Ca-41 [ETUDE DES PROBABILITIES DES TRANSITIONS ELECTROMAGNETIQUES DANS LE CA-41]
Henri Laurent (Ph.D. Thesis) 5 Feb. 1971 64 p refs In FRENCH
(NP-18812) Avail: AEC Depository Libraries

The lifetimes of eight levels of Ca-41 excited in the reactions K-41(proton, neutron) up to 4.3 MeV and Ca-40 (deuteron, proton, photon) between 3.75 and 4 MeV were measured, and the limits are given for four other levels. The method of Doppler effect attenuation was used. The accuracy is about 25 percent for lifetimes between 2 x 10 to the minus 14th power and 5 x 10 to the minus 13th power s. The experimental results are compared to those obtained from various existing models (the Gersce and Green model, the Federman model for negative parity levels, the Dieperinck and Brussaard model for positive parity levels). The comparison confirms the image of an almost full core for Ca-40. The excitation of many particles in the Ca-40 core must be taken into account if the various characteristics of the Ca-41 levels are to be explained. NSA

N71-38924# National Inst. for Metallurgy, Johannesburg (South Africa).
RHYTHMIC ACTIVATION ANALYSIS
J. P. F. Sellschop, E.-A. Ulen, and T. W. Steele 18 Jul. 1970 7 p refs
(NIM-887) Avail: AEC Depository Libraries

A simple, loop sample-transfer system for the recognition, study, and determination of very short-lived isotopes by rhythmic neutron-activation analysis is described. Author

N71-38925# Paris Univ. (France).
GAMMA AND ALPHA IRRADIATIONS OF AERATED AND DEGASSED SOLUTIONS OF AMERICIUM AND NEPTUNIUM [IRRADIATIONS GAMMA ET ALPHA DE SOLUTIONS AQUEUSES AEREES ET DEGAZEES D'AMERICIUM ET DE NEPTUNIUM]
Joel Pellerin (Ph.D. Thesis) [1971] 50 p refs In FRENCH
(NP-18784) Avail: AEC Depository Libraries

The effect of gamma and alpha ionizing radiations on aerated and degassed aqueous solutions of neptunium ions was studied. The considerable long term effects observed in the gamma radiolysis of these solutions led to a study of the action of H2O2 on Np(IV), (V), and (VI) solutions in 0.8N H2SO4 and 0.2N HClO4, and also the Np(V) amphoterization reaction. The absorption spectrum of a Np(IV) peroxide complex in 0.2N HClO4 solution was obtained in particular. Under gamma irradiation in sulfuric solution, solutions of Np(VI) and Np(V) tend towards a mixture of the (VI) and (V) oxidation states. In Np(IV) solutions the presence of the (V) and (VI) oxidation states are also observed. Under alpha irradiation, sulfuric acid solutions of neptunium develop towards a mixture of the (IV) and (V) oxidation states. In perchloric acid solution the reduction of Np(VI) is fast. Under alpha or gamma irradiation, solutions of Np(V) are stable. Aerated solutions of Np(IV) are oxidized with yields identical to those obtained for the oxidation of sulfuric acid Fe(II) solutions. NSA

N71-38926# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy.
SYSTEM FOR DEPRESSION OF THE MAGNETIC FIELD PULSATIONS IN THE DUBNA SYNCHROPHASOTRON
A. A. Smirnov, L. N. Belyaev, A. Z. Doroshenko, and D. P. Kalmykov 1971 11 p refs In RUSSIAN
(JINR-P9-5724) Avail: AEC Depository Libraries

The scheme, connected by means of an LC-filter thyratron, forms the basis of the system for depression of the magnetic field pulsations in the Dubna synchrophasotron. The system has a rather high coefficient of depression for the components of 500, 1000, and 1500 Hz, etc. of the accelerator magnetic field (for the component of 500 Hz the depression coefficient is 100). In order to reduce the capacity of the recharging rectifier and to save the power, the resistor is switched on with the help of an additional thyratron. The shielding of the depression system equipment is described. Author (NSA)

N71-38927# Joint Inst. for Nuclear Research, Dubna (USSR).
KINETIC MODEL OF THE PLANE HIGH-CURRENT ELECTRON-ION BEAM
S. B. Rubin 1971 14 p refs In RUSSIAN
(JINR-P9-5645) Avail: AEC Depository Libraries

An example of a precise solution of the self-consistent Vlasov equations for a two component system consisting of ions and electrons is considered. The solution is found in the form of a plane relativistic beam. The solution is provided for observing the Budker condition for relativistic beams. Consideration of the distribution of particle and current densities shows that the value of the total current per unit of the beam width can be great. Author (NSA)

N71-38928# International Centre for Theoretical Physics, Trieste (Italy).
GAUGE INVARIANT INFINITY SUPPRESSION IN GRAVITY MODIFIED QUANTUM ELECTRODYNAMICS
C. J. Isham, Abdus Salam, and J. Strathdee Apr. 1971 18 p refs
(IC/71/13) Avail: AEC Depository Libraries

It is argued that the use of a visibly localizable parametrization of the gravitational interaction yields a number of advantages. Firstly, the question of ambiguities can be completely solved: according to a theorem of Lehmann and Pohlmeyer there exists in such theories a unique minimally singular solution which it is natural to adopt as the physical one. Secondly, it is possible to show that this solution satisfies the usual requirements of analyticity and unitarity in the sense of perturbation theory. Thirdly, it is possible to arrange the computations in a manifestly gauge independent manner. These

points are briefly reviewed; the main object is to introduce a new technique for the treatment of those nonpolynomial Lagrangians in which the interaction terms are intimately associated with the free part. The gravity-modified theories exemplify this type of Lagrangian: in such theories the zero-graviton approximant to any process is credited in a sequence of graphs with arbitrarily large numbers of gravitons whose sum exists, is finite, free of ambiguities and gauge independent to any required order. Author (NSA)

N71-35929# Chalmers Univ. of Technology, Goteborg (Sweden). Inst. for Fysik.
TRANSMISSION AND RADIATION DAMAGE PHENOMENA IN ION BOMBARDMENT OF THIN FOILS
G. Hoegberg Dec. 1970 26 p refs
(GIPR-50) Avail: AEC Depository Libraries

Experimental work carried out during the period 1966 - 1970 is summarized. The thesis is based on seven earlier published papers dealing with ion transmission through carbon foils and through crystalline gold foils, as well as radiation damage in gold crystals by ion bombardment. Experimental arrangements are briefly described. NSA

N71-35930# Japan Atomic Energy Research Inst., Tokyo.
MEASUREMENT OF CENTRAL FISSION RATIOS AND FISSION RATE DISTRIBUTIONS IN FCA
T. Konishi, T. Ichimori, M. Obu, and N. Hirakawa Feb. 1971 36 p refs
(JAERI-Memo-4356) Avail: AEC Depository Libraries

Measurements of central fission ratios and the spatial distributions of fission rates in the radial direction were performed. Absolute fission counters were employed in the measurement of central fission ratios, and the standard deviations of the results were 2 to 4%. The most responsible factor for the final error is the ambiguity of the number of the fissionable atoms contained in the counters. Comparison of measured values with calculated ones suggests that the diffusion calculations with the JAERI-FAST and ABN sets give too many neutrons at high energies. As for the spatial distributions measured with relative counters, the most important point to be considered is how to correct the contributions from undesired isotopes in fission counters. In the blanket region the streaming effect through the experimental hole was observed to give no significant change on the enriched uranium counter response and to increase the natural uranium counter response by about 5% at most. Author (NSA)

N71-35931# Commissariat a l'Energie Atomique, Grenoble (France).
FAST NEUTRON SPECTRUM IN THE REFLECTOR OF A SWIMMING POOL REACTOR BEHIND METALLIC SLABS [SPECTRE DES NEUTRONS RAPIDES DANS LE REFLECTEUR D'UNE PILE A EAU LEGERE DERRIERE DES ECRANS METALLIQUES]
Jean-Claude Brousse (Ph.D. Thesis--Grenoble Univ.) 7 Oct. 1971 179 p refs In FRENCH
(CEA-R-3799) Avail: AEC Depository Libraries

The experiments which were performed in the reflector of the swimming pool reactor SILOETTE, behind Pb, Al, and Fe slabs, enabled the measurement of the large perturbations introduced in the fast spectrum by these materials. The neutron slowing down chiefly depends upon the inelastic reaction. The reaction cross section increases with energy which implies a spectrum softening. An attempt was made to calculate the shape of the spectrum and to fit the measurements. Calculations were made first in a one-dimensional geometry, using the NIOBE code to solve the transport equation and also the SANE Monte Carlo code. The results did not agree with the experimental values. A semi-empirical approach and a 3-dimensional geometry was then chosen; the results obtained were in perfect agreement with the measured values. The method is described. NSA

N71-35932# Atomic Energy Commission, New York. Health and Safety Lab.
APPENDIX TO FALLOUT PROGRAM Quarterly Summary Report, 1 Dec. 1970 - 1 Mar. 1971
1 Apr. 1971 406 p
(HASL-242-App) Avail: NTIS

Data are presented on the content of Sr-89 and Sr-90 in samples of atmosphere and precipitation collected at world wide sites and in samples of drinking water and milk collected in the U.S. from 1954 through 1970; the content of Cs-137 in drinking water in the U.S. from 1964 through 1970; and the gamma spectrometric determination of a number of radioisotopes in samples of atmospheric fallout collected at various locations in North, South, and Central America from 1963 through 1970. Data are included on the content of stable lead in surface air samples from 1966 through 1970. NSA

N71-35933# Oak Ridge National Lab., Tenn.
A FORTRAN PROGRAM FOR GAMMA-RADIATION DOSIMETRY FOR ARBITRARY SOURCE AND TARGET GEOMETRY
Lincoln B. Hubbard 29 Apr. 1971 21 p refs
(Contract W-7405-eng-26)
(ORNL-TM-3398) Avail: NTIS

The program DOSE1 calculate the first collision dose for gamma rays in arbitrary finite geometry of source, absorber, and target. The basic unit of the program is the subroutine ATINTG which calculates the attenuation term. The total volume, including both source and target, is subdivided into small rectangular parallelepipeds. The absorption is calculated as an exponential for each elementary volume traversed from the source volume to the target volume. The contributions from all sources are summed to give point-specific absorbed fractions for each elementary volume. The total absorbed fraction is the average of the point functions. The approach used differs markedly from the current dosimetry procedure using the Monte-Carlo method. Author (NSA)

N71-35934# Los Alamos Scientific Lab., N. Mex.
THE INTEGRATED COMPTON CROSS SECTION AND ITS USE IN A MONTE CARLO SCHEME
Gary S. Fraley Dec. 1970 18 p refs
(Contract W-7405-eng-36)
(LA-4592) Avail: NTIS

The differential Compton cross section is integrated over a relativistic Maxwellian electron distribution. The result, the cross section per final energy and angle of scatter, is then used in a Monte Carlo scheme that does not involve the use of large tables. Author (NSA)

N71-35935# Technische Hochschule Munchen (West Germany).
STUDIES OF DIFFERENT FITTING METHODS FOR DEVELOPING TRACE TRAJECTORIES AND DETERMINING MAGNETIC FIELD STRENGTH WITH THE HELP OF BUBBLE CHAMBER EVENTS [UNTERSUCHUNG VERSCHIEDENER ANPASSUNGSMETHODEN ZUR ERMITTLUNG VON SPURRADIEN UND BESTIMMUNG DER STAERK EINES MAGNETFELDES MIT HILFE VON BLASENKAMMEREREIGNISSEN]
Michael Ksoll (Ph.D. Thesis) 9 Oct. 1970 76 p refs In GERMAN
Avail: NTIS

Artificial tracing points are used for circular approximations by the reconstruction programs WELAGA and THRESH in parabolic and orthogonal polynomial trace fittings for determining track radii. Optimal tracing point distribution is obtained by varying projected error points, the number of tracing points and their distribution in trajectories, and the vector lengths and curvature radii of the traces. An example calculation determines the magnetic field from events observed in the bubble chamber; field strength is calculated by using median values from 44 events inside of 0.7% at a median scattering value of plus or minus 5.6% Transl. by G.G.

N71-35836# Brown Univ., Providence, R.I.
STUDY OF THE 1(PLUS)B MESON AS A PION OMEGA MESON BOUND STATE
Pu Shen and Kyungsik Kang 1970 28 p refs Sponsored in part by AEC
(NYO-2262-TA-238) Avail: NTIS

A reciprocal bootstrap calculation of the rho(1-) and B(1+) mesons in pion-omega meson scattering is performed whereby keeping both s- and d-wave interactions at the B sub (pi omega) vertex. Following previously developed general theoretical framework which treats the pseudoscalar and vector meson systems, the N/D solution is obtained algebraically through a pole approximation to the phase space integral at energies below threshold. Given rho meson mass at 765 MeV, reasonable results were found for B meson mass and decay widths and coupling constants. The angular distribution for the B decay was in good agreement with the experiment. Author (NSA)

N71-35837# California Univ., Berkeley. Lawrence Radiation Lab.
A STUDY OF KAON(PLUS) PROTON AND KAON(PLUS) DEUTERON INTERACTIONS AT 1.685 GeV/c
Victor Harrison Seeger (Ph.D. Thesis) 4 Jan. 1971 112 p refs (Contract W-7405-eng-48)
(UCRL-20628) Avail: NTIS

The 25-inch bubble chamber filled first with hydrogen and then with deuterium was exposed to incident positive kaons. Single and double pion production reactions and the charge exchange reaction were studied. Single pion and double pion production cross sections were obtained. Single pion production is dominated by kaon Delta hyperon and kaon resonance nucleon production. Kaon resonance Delta hyperon, kaon resonance background, and Delta hyperon background interferences were observed. The cross section for kaon resonance production in the I = 0 channel in single pion production was obtained and its production and decay angular distributions were studied in terms of t channel analysis. Its production was almost entirely via pseudoscalar exchange. A rough model involving pion, rho meson, and omega meson exchange accounts for the general features of neutral and positive kaon resonance production. The differential cross section for the charge exchange reaction, and the absolute value of the ratio of the real part of the scattering amplitude in the forward direction to the imaginary part were found to be in good agreement with Regge theory prediction.
Author (NSA)

N71-35838# Lyon Univ. (France). Inst. de Physique Nucleaire.
DESCRIPTION OF ELASTIC SCATTERED PROCESSES WITH THE USE OF NONLOCAL SEPARABLE POTENTIALS
J. Pigeon, J. Barguil, C. Fayard, G.-H. Lamot, and E. El Baz Dec. 1970 49 p refs
(LYCEN-7089) Avail: AEC Depository Libraries

Elastic scattering processes are studied using nonlocal separable interactions. An explicit general expression for the transition amplitude is given which includes Coulomb effects and possible excitation of the particles involved. An application of this formalism is presented in which a great improvement to Morgan's results of elastic p-p scattering is made by simply including Coulomb effects at low energy. The elastic nucleon-alpha scattering below 50 MeV and the elastic alpha-alpha scattering below 100 MeV are studied; the results obtained are in very good agreement with experimental data. Author (NSA)

N71-35839# Massachusetts Inst. of Tech., Cambridge.
HELICITY POLES, TRIPLE REGGE BEHAVIOR, AND SINGLE PARTICLE SPECTRA IN HIGH ENERGY COLLISIONS
C. E. De Tar, C. E. Jones, F. E. Low, N. H. Weis, J. E. Young et al 15 Mar. 1971 8 p refs
(Contract AT(30-1)-2098)
(NYO-2262-TA-234) Avail: NTIS

Following Mueller, the single-particle production spectrum is related to a discontinuity in a six-line amplitude through a generalized optical theorem. Assuming only analyticity of the sixline amplitude in its angular moments, a general expression is obtained for the behavior of the production spectrum near the phase-space boundary. To study the asymptotic limit appropriate to this region use is made of analytic continuation to complex helicities. Author (NSA)

N71-35840# Laboratoire de Physique Theorique et des Hautes Energies, Orsay (France).
PHOTOPRODUCTION OF CHARGED PIONS ON DEUTERON
J. P. Leroy (Ph.D. Thesis), J. Michell (Ph.D. Thesis), and D. Pignon (Ph.D. Thesis) May 1971 60 p refs
(LPTHE-71/9) Avail: NTIS

The analysis and numerical results are presented of an application of the Khuri Treiman formalism to obtain a completely relativistic model for photoproduction of pions on deuterons. Special attention is paid to the pion(-)/pion(+) ratio. Using a multipole set, the agreement with experiment is satisfactory up to 250 MeV, although the value for the ratio is a little small at very low energy. In view of the large uncertainities on the multipoles, it does not seem to be possible to extract the gamma-rho meson-pion coupling constant from experiments.
Author

N71-35841# Technische Hogeschool, Delft (Netherlands).
EXPERIMENTAL AND THEORETICAL ANALYSIS OF FAST NEUTRON SPECTRA
Hugo van Dam (Ph.D. Thesis) Jun. 1971 115 p refs
Avail: NTIS

The relationship between neutron energy distributions and fast reactor system parameters, with regard to economics and safety is discussed after a historical sketch of nuclear reactor development. An analysis of incore fast neutron spectrometry by means of proton-recoil proportional counters is given. The neutron transport equation is analyzed in some detail with special emphasis on the treatment of anisotropic scattering. A discussion is given of group cross section evaluation and for both diffusion and transport calculations, group cross section definitions are derived. The results of calculations and measurements of neutron energy distributions in the FANCY-assembly are included. J.G.M.

N71-35842# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics.
NEUTRON RESONANCES OF THE SAMARIUM ISOTOPES
E. N. Karzhavina and A. B. Popov 1971 28 p refs In RUSSIAN
(JINR-P3-5855) Avail: AEC Depository Libraries

Neutron transmission and yield of gamma rays from neutron capture by Sm samples with different isotopic structures were measured using a neutron spectrometer with a 6 nsec/m resolution. An isotopic identification was performed; and the resonance parameters for Sm-147 and Sm-149 in the region up to 400 and 250 eV, respectively, were determined. The values of average distances between levels and of strength functions for Sm-147 and Sm-149 were also obtained. Author (NSA)

N71-35843# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions.
PRODUCTION OF THE SPONTANEOUSLY FISSIONABLE ISOMER U-236 BY THE RADIATIVE THERMAL NEUTRON CAPTURE
A. G. Belov, Yu. P. Gangrskii, B. Delikhsuren, and A. M. Kucher 1971 13 p refs In RUSSIAN
(JINR-P7-5497) Avail: AEC Depository Libraries

The spontaneously fissionable isomer U-236 with T sub 1/2 = 70 ns was produced by the radiative capture of thermal neutrons. The ratio between the cross section of the reaction leading to the isomer production and U-235 fission is about .0004. Delayed conversion electron coincidences and the fission fragments were measured. Author (NSA)

N71-35944# Paris Univ., Orsay (France). Faculte de Sciences.
STUDY OF PROTON HOLES IN THE (2s-1d) SHELL FROM THE (d, He-3) REACTIONS AND COMPARISON WITH (p,2p) REACTIONS
Meryse Arditi (Ph.D. Thesis) 1970 82 p refs In FRENCH
(NP-18511) Avail: AEC Depository Libraries

The (d,He-3) reactions with nuclei of (2s-1d) shells from Mg-24 to Si-28 were studied in order to complete results obtained from (p,2p) experiments using the same nuclei, and to facilitate their interpretation, particularly with regard to anomalous distributions. The high energy of the deuterons (82 MeV) permitted, for the case of Mg-24, the study of the residual nuclear states up to an excitation energy of 11 MeV. Achromatic optics allowed a reduction of beam energy from 350 to 180 keV. A transfer 1 = 1 at weak excitation energies was revealed. The results of the stripping experiments and the absence of 1 = 3 transfer in the pick-up experiments demonstrated that the effects arose from 1p and not 2p proton holes. The distribution in the (p,2p)reaction was interpreted with these results. Thus, the abnormal distributions were explained by the superposition of two distributions: a distribution corresponding to the removal of a 2s proton having undergone a weak distortion, and the extraction of a 1p proton having undergone a larger distortion.
Author (NSA)

N71-35945# Lyon Univ. (France). Inst. de Physique Nucleaire.
SUPERMULTIPLET SCHEME FOR LIGHT NUCLEI
Guy Burdet and Martine Perrin 10 Dec. 1970 18 p refs In FRENCH; ENGLISH summary
(LYCEN-7088) Avail: AEC Depository Libraries

A test of the supermultiplet model for light nuclei is proposed. Two odd-A multiplets are interpolated; there results are even oddlike multiplet for A = 4n. The positions of isobaric analog states with high isospin, and those of the specific states of SU4 appearing in certain reactions, are studied. It is shown that the values obtained for the ground states of the isobaric multiplets are very different from those deduced from the Garvey-Kelson mass formula. This indicates that much greater binding energies exist for neutron-rich nuclei and even, in some cases, stability against beta decay for nuclei lying at the extremes of the multiplet.
Author (NSA)

N71-35946# Uppsala Univ. (Sweden). Inst. of Physics.
MOESSBAUER INVESTIGATION OF IRON IN BORON
R. Waeppling, L. Haeggstroem, and S. Devanarayanan Feb. 1971 9 p refs
(UUIP-733) Avail: AEC Depository Libraries

Boron samples containing approximately 1 at. % iron were investigated. It was indicated that the iron atoms populate three different crystallographic positions. The isomer shifts obtained are far from the metallic values expected, indicating large rearrangements of electrons around the iron nuclei.
Author (NSA)

N71-35947# Helsinki Univ. (Finland). Research Inst. for Theoretical Physics.
COMMENT ON ANOMALOUS ELECTRON-PHONON TRANSPORT PROPERTIES OF IMPURE METALS
Henrik Smith Mar. 1971 6 p refs
(NP-18822) Avail: AEC Depository Libraries

The substantial deviations from additivity of electron-phonon and electron-impurity scattering are shown to result mainly from an unfortunate choice of trial function in the variational calculation of the resistivity.
Author (NSA)

N71-35948# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Moscow (USSR). Inst. Atomnoi Energii.
EVIDENCE OF DISAPPEARANCE OF THE INELASTIC CHANNEL OF THE NUCLEAR REACTION IN THE NUCLEAR RESONANT SCATTERING OF GAMMA-RAYS IN A PERFECT CRYSTAL
V. K. Voitovetskii, I. L. Korsunskii, A. I. Novikov, and Yu. F. Pazhin 1970 6 p refs
(IAE-1966) Avail: AEC Depository Libraries

The effect of disappearance of the inelastic channel of the nuclear reaction in resonant nuclear scattering of gamma-quanta as well as in other mechanisms of wave field formation in a perfect single crystal (nuclear and electron scattering interference, electron scattering) was investigated for a perfect tin single crystal containing Sn-119.
Author (NSA)

N71-35949# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics.
SOME NOTES ON THE PROBLEMS OF DETERMINING THE PHASES OF STRUCTURAL AMPLITUDES IN THE NEUTRON DIFFRACTION AND OF THE NEUTRON ACCUMULATION
F. L. Shapiro 1970 10 p refs In RUSSIAN
(JINR-P3-5554) Avail: AEC Depository Libraries

The possibility of determining the phases of structural amplitudes for polarized neutron diffraction on a crystal whose elementary cell contains a paramagnetic center is considered. The question of the limiting neutron density in a neutron trap is discussed.
Author (NSA)

N71-35950# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
ALGEBRAIC REALIZATION OF CHIRAL SYMMETRY FOR MESON SYSTEMS AND THEORY OF YANG-MILLS TYPE
B. M. Zupnik and V. I. Ogievetskii 1971 22 p refs In RUSSIAN
(JINR-P2-5759) Avail: AEC Depository Libraries

The applicability of algebraic realizations of SU(2) x SU(2) to mesons with GP(-1) sup J = 1 is investigated. This question arises due to the peculiar form of pion couplings with the above mesons in the chiral dynamics. A procedure is discussed how to take into account the pion mass. It is shown also that the algebraic realization of chiral symmetry is compatible in principle with a theory based on a nonlinear realization of SU(2) x SU(2) for the massive Yang-Mills fields. A combined application of these approaches to pions, sigma mesons, rho mesons and A1 mesons with zero helicity gives satisfactory relations for masses and decay widths. However this meson family is not large enough to derive consistent results for helicity + or - 1.
Author (NSA)

N71-35951# European Organization for Nuclear Research, Geneva (Switzerland).
PROCEEDINGS OF THE 1970 CERN SCHOOL OF PHYSICS
16 Feb. 1971 381 p refs Conf. held at Loma-Koli, Finland, 21 Jun. - 5 Jul. 1970
(CERN-71-7) Avail: AEC Depository Libraries

The four lectures presented during these proceedings included: a review of selected topics in electromagnetic interaction theory; a discussion of the properties of weak leptonic currents, higher orders in weak interaction theory, and the violation of CP invariance; a review of modern developments in hadron physics; and a discussion of the correlation between resonances and Regge poles with several dual models considered.
J.G.M.

N71-35952# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics.
SOME PROBLEMS OF CHOOSING AND CALCULATING THE FOCUSING SYSTEM OF 30 MeV LINEAR INDUCTION ACCELERATOR
Yu. P. Vakhrushin, N. I. Ivanova, O. L. Komarov et al 1971 9 p refs In RUSSIAN
(JINR-P9-5714) Avail: AEC Depository Libraries

The problem of selecting the focusing system for the 30 MeV linear induction accelerator is considered. Calculations for maintaining the radial dimensions of beam in the accelerator

during the working part of the accelerating pulse are presented. A laminar stream of electrons is assumed. NSA

N71-38863# Kernforschungszentrum, Karlsruhe (West Germany).
THEORETICAL STRUCTURAL LEVEL AND ABSOLUTE TRANSITION PROBABILITIES IN DEFORMED NUCLEI OF UNEVEN MASS NUMBERS [THEORETISCHE NIVEAUSTRUKTUR UND ABSOLUTE UEBERGANGSWAHRSCHEINLICHKEITEN IN DEFORMIERTEN KERNEN UNGERADER MASSENZAHL]
F. Weller and G. Markus Nov. 1970 24 p refs In GERMAN, ENGLISH summary
(KFK-1248) Avail: AEC Depository Libraries

Calculations based on the collective model and extension of the usual Coriolis-coupling band-mixing calculations by the inclusion of rotation-vibration interactions and quasi-particle-phonon interactions are presented. The success of the method depends on a careful treatment of the pairing correlations, which have a striking influence. The theoretical level structures of various nuclei are calculated. Allowed and K-forbidden gamma-ray transitions in these nuclei are calculated and compared with the experimental values. In most cases the agreement for M1 is good, while the E1 transitions are about an order of magnitude too fast. Author (NSA)

N71-38864# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy.
COHERENT INTERACTIONS OF NEGATIVE PIONS WITH THE PHOTOEMULSION NUCLEI AT 17 GeV
S. A. Azimov, V. G. Grishin, U. G. Gulyamov et al 1971 15 p refs In RUSSIAN
(JINR-P1-5565) Avail: AEC Depository Libraries

A new technique of selection of the coherent interactions is described. Using this technique the paths equal to 53 + 7 or - 5 m and 3.8 + 1.5 or - 1.6 km, respectively, were obtained for coherent reactions negative pion + nucleus yields negative pion negative pion positive pion + nucleus and negative pion + nucleus yields negative pion negative pion negative pion positive pion positive pion + nucleus on the photoemulsion nuclei at 17 GeV. Author

N71-38865# Lyon Univ. (France). Inst. de Physique Nucleaire.
DECAY SCHEME OF 1.3 h Te 174
A. Charvet, Do Huu Phuoc, R. Duffait, A. Emsallem, and R. Chery 19 Nov. 1970 23 p refs
(LYCEN-7084) Avail: AEC Depository Libraries

The decay was investigated using Ge(Li) and Si(Li) detectors. Single, coincidence, and sum gamma ray spectra, conversion lines, and e-gamma coincidence relations were studied. The results are in good agreement with those of earlier investigations on the ground state and beta vibrational bands. Above these bands 14 levels, spin values, and parities were established. The level scheme accounts for 49 of the 60 well-established transitions in the decay of Te-174. The Q-value corresponding to the Te-174 yields Hf-174 decay was found to be 3645 + or - 60 keV. The half life of the first 2(+) level was remeasured and found to be 1.68 + or - 0.08 ns. The structures of Te-174 and of the Hf-174 levels are discussed in terms of current nuclear models. Author (NSA)

N71-38866# Commissariat a l'Energie Atomique, Grenoble (France). Centres d'Etudes Nucleaires.
FAST ANALYSIS BY 14-MeV NEUTRON ACTIVATION OF FLUORINE DEPOSITS ON THE VEGETATION IN A POLLUTED AREA [ANALYSE RAPIDE PAR RADIOACTIVATION SOUS NEUTRONS DE 14 MEV DES DEPOTS DE FLUOR SUR LA VEGETATION EN ZONE POLLUEE]
J.-P. Garros Jul. 1970 6 p refs In FRENCH Presented at 3d European Fluorine Chem. Symp., Aix-en-Provence, France, 14 Sep. 1970
(CEA-CONF-1747) Avail: AEC Depository Libraries

A method of detecting fluorine by activation with 14-MeV neutrons and gamma spectrometry is described. This method allows pollutions up to 2000 ppM to be measured. Several nuclear reactions occur when fluorine is irradiated with 14-MeV neutrons. The reaction F-19(n,p) O-19 was the most convenient for the determination of fluorine. The 200-keV gamma radiation from O-19 was measured (half-life 29sec). The characteristics of the analysis are as follows: irradiation time, 1 min; radioactive decay, 30 sec; counting time, 30 sec; analysis, 5 min. The method is rapid and the sampling can be used for other investigations. NSA

N71-38867# Kernforschungsanlage, Juelich (West Germany). Inst. fuer Festkoerperforschung.
ON THE SCATTERING OF SLOW NEUTRONS BY ORTHOHYDROGEN IN THE CUBIC PHASE
R. Stockmeyer Jan. 1971 23 p refs
(JUL-724-FF) Avail: AEC Depository Libraries

The scattering law for slow neutrons scattered by solid ortho-hydrogen at low temperature in the cubic, orientationally ordered phase was derived. The creation of phonons and angular momentum waves was taken into account. Author (NSA)

N71-38868# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Moscow (USSR). Inst. Teoreticheskoi i Eksperimentalnoi Fiziki.
PROGRAM FOR PROCESSING PHOTOGRAPHS IN A BUBBLE CHAMBER FILLED WITH A HEAVY LIQUID, PART 1 [PROGRAMMA OBRABOTKI FOTOGRAFII V PUZYRKOVOI KAMERE S TYAZHELOZHIDKOSTNYM ZAPOLNENIEM, CHAST 1]
N. V. Marchenko, E. N. Marchenko, A. S. Novikov, S. I. Spivakovskii, and Yu. V. Trebukhovskii 1969 54 p refs In RUSSIAN
(ITEF-753) Avail: AEC Depository Libraries

Interaction of neutral pions and gamma quants or decomposition of neutral particles into neutral pions and gamma quants must be studied with a bubble chamber filled with a liquid heavier than liquid hydrogen, such as propane, freon, xenon, etc. In order to take into account the interactions, slowing-down effects and radiative emissions, a special program which has been developed, for such chambers must be used. Such a program was developed for studying reactions with a 120-liter chamber, consisting of an 84-cm high and 38-cm diameter cylinder. The program helped to identify the type of reaction represented in the photographic track, indicating whether it is an incoming particle, a proton, or a gamma quantum. The results of the study of the elastic scattering of 20 pion(-) + p yields pion(-) + p events are presented, indicating the radii of charged particles, their angle of emission and the length of passage. In a study of (positron electron) pairs, the mass of the neutral pion was determined by measuring the pion(-) + p yields n + 4gamma reaction. NSA

N71-38869# California Univ., Berkeley.
LIFETIME OF THE 2 1S0 STATE OF HELIUM LIKE ARGON
R. W. Schmieder and R. Marrus Mar. 1971 8 p refs
(Contract W-7405-eng-48)
(UCRL-20488) Avail: NTIS

Measurement of the lifetime of the 2 1S0 state of the heliumlike atom Ar17 in a beam-foil experiment is reported and compared with recent experimental and theoretical results. Author

N71-38870# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy.
CROSS SECTIONS OF INELASTIC CHANNELS OF REACTIONS IN np-INTERACTIONS AT THE NEUTRON MOMENTUMS FROM 2 TO 10 GeV/c
A. P. Gasparyan, A. V. Nikitin, and Yu. A. Troyan 1971 24 p refs In RUSSIAN

(JINR-P1-5665) Avail: AEC Depository Libraries

A method of separation of the channels of the reactions neutron proton yields neutron proton pion(+) pion(-) and neutron proton yields neutron proton pion(+) pion(-) m pion(0), m = 1,2,..., is suggested and the cross sections of ten inelastic reactions in np-interactions are obtained. Author (NSA)

N71-35961# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy.

ELASTIC pp- AND pd-SCATTERING AT 50 AND 70 GeV

P. A. Devenski, V. I. Zayachki, Z. M. Zlatanov et al 1971 10 p refs In RUSSIAN

(JINR-P1-5633) Avail: AEC Depository Libraries

The differential cross sections for elastic pp-scattering at 50 GeV and pd-scattering at 70 GeV in the region of four momentum transfer are determined. The slope parameters are also determined. The following results are obtained: B sub pp equals (11.06 + or - 0.28) (GeV/c)sq and B sub pd equals (40.7 + or - 0.7) 1/(GeV/c) sq. Author (NSA)

N71-35962# Rochester Univ., N.Y.

SOME RECENT HIGH ENERGY HEAVY ION CYCLOTRON PROJECTS

K. H. Purser Mar. 1971 36 p refs

(UR-NSRL-38) Avail: NTIS

Characteristics of cyclotrons and types of ion source injectors for use in high-energy heavy-ion cyclotrons are briefly discussed. The Dubna isochronous cyclotron; heavy-ion cyclotrons with prestripping and the effectiveness of prestripping; split-sector cyclotrons; injection and extraction; resonance problems; flat topping; and basic parameters are included. J.M.

N71-35963# Tokyo Univ. of Education (Japan). Dept. of Physics

TWO PARTICLE DISTRIBUTIONS IN DUAL RESONANCE MODEL

Sunao Sakai Jul. 1971 19 p refs

(TUEP-71-29) Avail: NTIS

Two particle distributions are investigated in the framework of a dual resonance model. The distribution functions are limited to the following cases; produced particles are both in the fragmentation region of the target, or the projectile, both particles are in the pionization region, and one is in the fragmentation region of the target and the other is in that of the projectile. However in case one is in the fragmentation region while the other is in the pionization region, the distribution function decreases rapidly. In case two, the distribution function shows exponential cut off with respect to the transverse momentum of the produced particles in the rest frame of the target. It also shows exponential cut off with respect to their invariant mass. Author

N71-35964*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

EVALUATION OF ION DENSITY AND PLASMA POTENTIAL FROM LANGMUIR PROBE DATA

Roman Krawec Washington Sep. 1971 25 p refs

(NASA-TM-X-2369; E-6401) Avail: NTIS CSCL 20H

The collisionless probe theory of Laframboise is used to calculate values of probe current for a plasma composed of electrons and ions with equal temperatures and Maxwellian velocity distribution functions. Specifically, the value of probe current is given as a function of ion density for a probe biased at a voltage 5kt/q below probe floating potential, where k is Boltzmann's constant, T is temperature, and q is the electron charge. Author

N71-35965# Scientific Translation Service, Ann Arbor, Mich.

ANISN SYSTEM: DESCRIPTION AND SERVICE INSTRUCTIONS FOR THE ANISN DISCRETE ORDINATE PROGRAM AND SUBROUTINES

Christian Devillers Oct. 1970 90 p refs Transl. into ENGLISH from French report CEA-N-1358 Sponsored by AEC Prepared for ORNL

(ORNL-TR-2419) Avail: NTIS

Most of the data required for using the ANISN program (discrete ordinates) and the auxiliary programs, in the case of problems relating to one dimensional transport of neutrons and gamma rays, are given. Detailed explanations concerning the preparation of the data and the cross section library pre-processing are given and are illustrated by examples. The principle of the numerical method used by ANISN is presented in an appendix. Author (NSA)

N71-35966# Commissariat a l'Energie Atomique, Saclay (France).

ELECTRONIC MICROSCOPE STUDY OF NEEDLE-SHAPED PRECIPITATES IN IRRADIATED AUSTENITIC STEELS

Andre Bisson et al Sep. 1970 12 p refs Transl. into ENGLISH from French report Sponsored by USAEC-EURATOM

(EURFNR-891) Avail: NTIS

Irradiation of 316 austenitic steel by neutrons causes the formation of small precipitates in the /110/ planes of the crystal. There are very thin, long tags having the greatest dimension in the <100> direction. Their thickness is about 50 A. The nature of these precipitates is still unknown. However, it may be supposed from their instability that they are not M23C6. It is important to note that they would be preferential sites for cavities. Author (NSA)

N71-35967# Australian National Univ., Canberra. Dept. of Nuclear Physics.

A NOTE ON THE EXTRAPOLATION OF THE C-12 PLUS C-12 AND C-12 PLUS O-16 REACTION CROSS SECTIONS TO ASTROPHYSICAL ENERGIES

B. N. Nagorcka, G. D. Symons, W. M. Zuk, and J. R. Patterson (Adelaide Univ.) [1971] 3 p refs

(ANU-P-515) Avail: AEC Depository Libraries

A previous extrapolation of the C-12 plus C-12 reaction cross section is re-evaluated in the light of new measurements of the C-12 plus O-16 reactions which suggest that the quasi-molecular resonances observed in these reactions do not contribute to the cross sections at the lowest energies. Author (NSA)

N71-35968# Tri-Univ. Meson Facility, Vancouver (British Columbia).

TECHNIQUES APPLIED TO THE DESIGN OF THE TRIUMF MAGNET POLES

S. Orase Dec. 1970 54 p refs

(TRI-70-4) Avail: AEC Depository Libraries

An empirical method is given for calculating the magnet pole tip shape required to contain a 500 MeV beam of H(-) ions. The method is good only for small changes in the shape. An empirical solution to the problem of finding the field inside the magnet air gap is also given. The magnetic field resulting from a given pole tip contour is calculated at a point on the median surface by finding the perpendicular distance from the point to the edge of the pole and comparing this to an experimentally measured curve of field against distance. Fields generated by this technique have their averages correct to within 70 G and flutter to within 8%. The method and results of calculating the pole edge position tolerances for the latest model magnet are given. The field strengths inside the steel return yoke as obtained from a series of flux measurements are also presented. It is shown that a simple approximation to the magnetic circuit of the magnet predicts the coil induction required to an accuracy of only 25%. Author (NSA)

N71-35969# Joint Inst. for Nuclear Research, Dubna (USSR).

TIMING WITH Ge(Li)-DETECTOR

Yu. K. Akimov, K. Andert, A. I. Kalinin, I. N. Churin, and V. N. Shurevin 1971 10 p refs In RUSSIAN

(JINR-P13-5708) Avail: AEC Depository Libraries

The time resolution of 2.2 nsec was obtained in the energy range of 0.07 to 1.33 MeV when gamma-quants from Co-60 were detected by the Ge (Li)-detector (the volume being 3 cu cm) and by a scintillation counter. The coincidence curve width at the level 0.1 of its height was 12.5 nsec. The time resolution of 0.9 nsec was obtained for the narrow range of energies.

Author (NSA)

N71-35870# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.

THE n, GAMMA DISCRIMINATION IN RECOIL-PROTON PROPORTIONAL COUNTERS. APPLICATION TO THE MEASUREMENT OF FAST NEUTRON SPECTRA [DISCRIMINATION N, GAMMA DANS LES COMPTEURS PROPORTIONNELS A PROTONS DE RECUL. APPLICATION A LA MESURE DES SPECTRES DE NEUTRONS RAPIDES]

Claude Jeandidier, (Ph.D. Thesis - Paris Univ.) 1969 72 p refs In FRENCH

(CEA-R-3823) Avail: AEC Depository Libraries

A description is given of a spectrometry chain working in the energy range of a few keV to 1 MeV, and designed for measurement of fast neutron spectra. It consists of detectors, recoil proton proportional counters built especially for this work. A brief description is first given of the (n,p) collisions in the gas and the influence of gamma radiation, and the method of discrimination is then presented. It is based on the difference in the rise-times of the pulses. In the experiments described the use of a bi-parametric system made it possible to employ the most simple discrimination device, based on the fact that the high frequency gamma pulse components are, at a given energy, weaker than those of the neutron pulse. Results are given of measurements carried out on the Van de Graaff (monoenergetic neutrons for testing the linearity of the chain and the resolving power of the counters), and of those made in a subcritical system.

Author (NSA)

N71-35871# Akademiya Nauk URSR, Kiev. Inst. Teoreticheskoi Fiziki.

LIGHT ABSORPTION BY THE PAIR OF TRIPLET EXCITONS

Yu. B. Gaididei and E. G. Petrov 1970 20 p refs In RUSSIAN; ENGLISH summary

(ITF-70-74) Avail: AEC Depository Libraries

Light absorption is investigated in the molecular crystal by a pair of triplet excitons with a singlet sum spin state. The conditions for bend and bounded states to exist are found. The shape of the bend absorption line is studied, and the formulas for the integral intensity of the considered absorption are given.

Author

N71-35872# Tokyo Univ. (Japan). Inst. for Nuclear Study.

DESIGN OF HIGH GRADIENT ACCELERATING COLUMN

S. Fukumoto, S. Inagaki, and T. Nishikawa Mar. 1971 18 p refs

(SJC-A-71-2) Avail: AEC Depository Libraries

A vertical model of the high gradient accelerating column is designed. The accelerating electrodes are determined by assuming a cylindrical rectilinear beam of 25 mm diameter. The proton beam is accelerated by 6 gaps and the total gap length is about 18 cm. A 750 keV proton beam of 500 mA is to be extracted if a plane disk of the ion emissive surface is formed.

Author (NSA)

N71-35873# Paris Univ., Orsay (France). Lab. de l'Accelerateur Lineaire.

HIGH RESOLUTION BEAM HODOSCOPE USING MULTIWIRE PROPORTIONAL CHAMBERS

B. Merlet Mar. 1971 15 p refs

(LAL-1246) Avail: AEC Depository Libraries

A multiwire proportional chamber with 1 mm spacing and 2.5 mm gap, using 9 micron tungsten wires was built for use as a precise beam hodoscope. An electronegative vapor (freon 13 B 1) was used to restrict the sensitive region to a small volume around the wire. In order to obtain a high detection efficiency for relativistic particles, i.e. a high probability of producing one ion pair in the sensitive volume around the wire, xenon was used as filling gas, with propylene as co-xenon (quencher). An arrangement of four identical chambers, staggered so as to give an effective wire spacing of 0.25 mm, gives a high detection efficiency (98.8 + or - 0.15% for 400 MeV electrons) together with good spatial resolution. Measurements using a collimated electron beam give a trajectory determination with 0.15 mm accuracy (half width at half maximum).

Author (NSA)

N71-35874# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Experimentelle Kernphysik.

He 4 FINAL STATE INTERACTIONS AND QUASIFREE SCATTERING IN DEUTERON-INDUCED THREE-PARTICLE REACTIONS ON Li-6 [HE-4-ENDZUSTANDSWECHSELWIRKUNG UND QUASIFREIE STREUUNG BEI DEUTERONENINAUZIERTEN DREITEILCHENREAKTIONEN AN Li-6]

R. Hagelberg Dec. 1970 56 p refs In GERMAN; ENGLISH summary

(NP-18741) Avail: AEC Depository Libraries

Excited states of He-4 were investigated through final-state interactions in the three-particle reactions Li-6(d,alpha 1)H-1, Li-6(d,alpha He-3)n, and Li-6(d,alpha d)D by using 52 MeV deuterons. In measuring the differential cross sections, the detector of the first outgoing particle was kept at a fixed position and the second detector scanned over a range of coplanar angles favoring He-4 final-state interactions. The data can be fitted consistently with four isospin T = 0 excited states of He-4 at 21.9 MeV, 25.5 MeV, 28.5 MeV, and 31.8 MeV with widths (Gamma) of 1.8 MeV, 2.9 MeV, 5.3 MeV, and 5.6 MeV, respectively. The 21.9-MeV and the 25.5-MeV states are particularly strongly excited. From the angular correlation the spin assignment for the latter is confirmed to be 0(+) or 1(+). No evidence is found for a narrow state at 23.9 MeV. The internal consistency of the level parameters for the three different reactions as well as their good agreement with the parameters obtained by experiments using two other entrance channels with the same three decay channels confirm the model of sequential decay.

Author (NSA)

N71-35875# Akademiya Nauk URSR, Kiev. Inst. Teoreticheskoi Fiziki.

RIEMANN METHOD IN THE INVERSE PROBLEM, 4

E. I. Gugushvili 1970 10 p refs In RUSSIAN; ENGLISH summary

(ITF-70-56-P) Avail: AEC Depository Libraries

The generalization of the Gel'fand-Levitan method for the case of the charged particles scattering is carried out. The Riemann method is applied for studying the nuclei A sub e sup e (pi,rho) and A bar sub e sup e (pi,rho). This permits the properties of these nuclei to be investigated simultaneously.

Author (NSA)

N71-35876# California Univ., Livermore. Lawrence Radiation Lab.

HAZARDS CONTROL Progress Report, Sep. - Dec. 1970

Dec. 1970 18 p refs

(Contract W-7405-eng-48)

(UCRL-50007-70-3; PR-38) Avail: NTIS

The status of research activities in the fields of radiation protection, instrumentation, and environmental protection is briefly described.

NSA

N71-35877# Argonne National Lab., Ill.

ISOTOPE EFFECT FOR THE DIFFUSION OF INTERSTITIAL ATOMS

I. A. Murtazin Apr. 1971 10 p refs Transl. into ENGLISH from Fiz. Tverd. Tela., v. 13, no. 1, 1971 p 172-178 Sponsored

by AEC
(ANL-Trans-882) Avail: NTIS

An attempt was made to derive an expression for the quantity measured in the isotope effect and to investigate the role of the change in the vibration spectrum of the crystal, brought about by the diffusing atom, in the istope effect. It was calculated that the value of the isotope effect increases with increasing temperature. NSA

N71-35978# Princeton Univ., N.J. Joseph Henry Labs.
RAD SWAPPING SYSTEM FOR NUCLEAR DATA ACQUISITION
William C. Mead Apr. 1971 13 p Sponsored by AEC
(PUC-937-396) Avail: NTIS

A set of Symbol programs, which utilizes a Sigma 2, a RAD, and RBM to provide approximately 50,000 channels of active storage for data from nuclear scattering experiments, is described. The swapping program and the data-collection activities for a prototype experimental configuration are discussed. Author (NSA)

N71-35979# California Univ., Berkeley. Lawrence Radiation Lab.
GAMMA-RAY CALIBRATION STANDARDS
Leslie J. Jardine Apr. 1971 22 p refs
(Contract W-7405-eng-48)
(UCRL-20476) Avail: NTIS

A collection of gamma-ray energies and intensities is given that are suitable for use in the calibration of high resolution gamma-ray spectrometers. Adopted values are given for gamma-ray energies based on weighted averages of the stated uncertainties. Relative gamma-ray intensities are also given for Ba-133, Ta-182, and Co-56. No attempt was made to establish weighted averages for the intensity values. Author (NSA)

N71-35980# Edgerton, Germeshausen and Grier, Inc., Las Vegas, Nev.
USE OF AERIAL SURVEYS FOR DETERMINING PLUTONIUM CONCENTRATION
T. P. Stuart 29 Apr. 1971 10 p Presented at the Symp. on Safety in Plutonium-handling Facilities, Rocky Flats, Colo. 15 Apr. 1971
(EGG-1183-1517; Conf-710401-2; L-1030) Avail: NTIS

A Pu aerial survey using an array of NaI detectors that are set up to sense the 60 KeV gamma ray from Am-241, a decay product of Pu-241 is described. The detecting system was mounted inside an Air Force helicopter and flown over known concentrations at the Nevada Test Site. Author (NSA)

N71-35981# Syracuse Univ., N.Y. Dept. of Chemical Engineering and Metallurgy.
SEPARATION OF KRYPTON AND XENON FROM REACTOR ATMOSPHERES BY SELECTIVE PERMEATION Progress Report, 1 Jan. 1969 - 31 Dec. 1970
S. Alexander Stern and S. K. Sen 31 Dec. 1970 94 p refs Sponsored by AEC
(NYO-4057-2) Avail: NTIS

Studies are being made to determine the most economical method of separating radioactive Kr-85 and Xe133-135 from air within a nuclear reactor containment dome after an accidental release of fission products. A permeation cascade using asymmetric cellulose acetate membranes was evaluated. Permeability, diffusion, and solubility coefficients were determined using nonradioactive krypton and xenon. It was confirmed that gas transport across cellulose acetate membranes occurs by a solution-diffusion mechanism. However, second-order transitions were found to affect the permeability. Permeation rates were much higher through asymmetric membranes than through symmetric ones, but the separation factors were very different. Author (NSA)

N71-35982# Case Western Reserve Univ., Cleveland, Ohio. Dept. of Chemistry.
PRIMARY PROCESS IN RADIATION CHEMISTRY
Edwin W. Abrahamson [1970] 41 p refs
(Contract AT(11-1)-904)
(TID-25689) Avail: NTIS

Quenching of excited iodine atoms and photosensitized production of excited singlet oxygen species and their reactivity are reported. The emission of I at 1.315 microns following the flash photolysis of CF3I-inert gas mixtures was monitored. The flash spectroscopy and photoreduction of phenazine were studied. Emission from O2 was detected following the flash photolysis of O2 and 1-fluoronaphthalene mixtures. The quenching of O2 by the fluoronaphthalene was estimated to be 7.8 + or - 0.7 X 10 to the 8th power M(-1) sec(-1). NSA

N71-35983# California Univ., Livermore. Lawrence Radiation Lab.
ESTIMATING NATURAL TERRESTRIAL BACKGROUND IN THE 17- AND 60-keV ENERGY REGIONS FROM THE COMPTON CONTINUUM PEAK
C. L. Lindeken, D. J. Hodgkins, and T. O. Hoeger 1 Apr. 1971 12 p refs Presented at Symp. on safety in Plutonium-Handling Facilities, Rocky Flats, Colo., 13-16 Apr. 1971
(UCRL-72927; Conf-710401-1) Avail: NTIS

A study of terrestrial natural gamma background in the energy region of 10 to 100 keV showed that, whereas counting rates varied with geographical location, the percentage of the total activity within any given 10-keV interval was reproducible within about 5%. As a result, the 10 to 100 keV natural background gamma spectrum can be calculated from a counting rate measurement within this energy range. This technique, using thin NaI(T1) crystals, is proposed for estimating natural background, which interferes in detection of low-level plutonium surface contamination. Here detection is based on measurement of either the 17-keV X-ray band or the 60-keV gamma from Am-241, the latter normally present through beta decay of Pu-241. The 60-keV Compton continuum peak is used for calculating background contribution in these two energy regions, since it provides the best counting statistics and is above the plutonium contamination energies. Author (NSA)

N71-35984# Michigan State Univ., East Lansing. Dept. of Chemistry.
ESR STUDIES OF RADIATION EFFECTS Technical Report, 1 Jan. - 31 Dec. 1970
31 Dec. 1970 6 p refs Sponsored by AEC
(COO-1385-37) Avail: NTIS

Single crystals of ammonium monofluoroacetate and ammonium difluoroacetate were irradiated at room temperature and ESR spectra of the CFHCOO(-) and CF2COO(-) radicals studied. Bromomalonic acid and mandelic acid were irradiated and radicals studied. Gamma-irradiated KAsF6 and chloral hydrate and some neutron irradiated compounds were also studied. Nuclear quadrupole resonance spectroscopy is also discussed. NSA

N71-35985# Iowa State Univ. of Science and Technology, Ames.
SURVEY OF ENVIRONMENTAL RADIOACTIVITY, 1 JANUARY - 31 DECEMBER 1970
Milo D. Voss Feb. 1971 37 p
(Contract W-7405-eng-82)
(IS-2541) Avail: NTIS

The environmental monitoring program for the Ames Laboratory Research Reactor (ALRR) is described. The environmental program consists of gross alpha and beta determinations of air, soil, vegetation, river water, ALRR outfall, bottom sediment, precipitation, well water, and pond samples. The ALRR reached full power on July 12, 1965. The ALRR had generated 105,409 megawatt hours as of Dec. 31, 1969. A total of 34,051 megawatt hours was generated in 1970. The data indicate that the ALRR has not contributed a significant

amount of radioactivity to the environment in the Ames area. The conclusion is reached that radioactivity levels recorded for environmental samples represent background conditions from atmospheric fallout and naturally occurring radioactivity.
Author (NSA)

N71-38986# California Univ., Berkeley. Lawrence Radiation Lab.
THE (n,p) ELASTIC SCATTERING: A FITTING EXPRESSION FOR THE DIFFERENTIAL CROSS SECTIONS IN THE ENERGY RANGE BETWEEN 22.5 AND 400 MeV
Alessandro Rindi, Chun Bin Lim, and Tullio Salmon-Cinotti (Bologna Univ., Italy) 20 Nov. 1970 18 p refs
(Contract W-7405-eng-48)
(UCRL-20295) Avail: NTIS

The differential cross sections for n + p elastic scattering at energies where the scattering is no longer isotropic in the cm system (i.e. for energies higher than about 10 MeV) are required for measurements of neutron fluxes and spectra. Two semiempirical formulae are proposed that fit the total n + p elastic scattering cross section with an acceptable approximation for, respectively, energies higher than 71 MeV and energies up to 71 MeV. Using these formulae, a rather sophisticated empirical expression for fitting the differential cross section data up to about 600 MeV is offered. With some of these results as a basis, a simpler expression fitting the experimental data with a better approximation is found.
Author (NSA)

N71-38987# Interuniversitair Reactor Instituut, Delft (Netherlands).
LOW ENERGY GAMMA-RAYS FROM ISOTOPES PRODUCED BY (n,GAMMA)-REACTIONS
M. de Bruin and P. J. M. Korthoven 1970 25 p Submitted for publication
(IRI-133-70-06) Avail: NTIS

The low energy/photon spectra of the isotopes and isotope mixtures produced from the natural elements by (n, gamma) reactions are measured. The measurements were carried out with a high resolution Si(Li)-detector. The spectra were computed using the program ICPEAK.
ESRO

N71-38988# Rome Univ. (Italy). Inst. di Fisica.
ARGAND DIAGRAM ANALYSIS OF THE POMERON COUPLING TO KAON NUCLEON AND ANTIKAON NUCLEON SYSTEM
W. J. Hogan (Northeastern Univ.), M. Restignoli, Y. Srivastava (Northeastern Univ.), and G. Violini 8 Jan. 1970 15 p refs Sponsored in part by Fondazione Angelo della Riccia and NSF
Its Nota Interna No. 295
Avail: NTIS

Argand diagram analyses of kaon nucleon and antikaon nucleon are presented to test the hypotheses regarding the identification of the diffraction term with the background and the decoupling of the Pomeron to the helicity flip amplitudes. While the uncertainties in the phenomenological analysis disallow from giving a definite answer, the data are found not to be in contradiction with both these hypotheses.
Author (ESRO)

N71-38989# Rome Univ. (Italy). Inst. of Physics.
REGGE CUTS AND FORWARD PION-NUCLEON SCATTERING
D. Schiff and G. Violini 18 Nov. 1970 12 p refs Sponsored in part by Fondazione Angelo Della Riccia
Its Nota Interna No. 290
Avail: NTIS

In order to obtain knowledge on the scattering amplitudes in pion-nucleon interactions at high energy, information is derived from a simultaneous fit to finite energy sum rules and total cross sections. The effect of cuts on the sum rules is discussed, and the conditions required to obtain a good fit to data are described.
Author (ESRO)

N71-38990# Edgerton, Germeshausen and Grier, Inc., Los Alamos, N. Mex.
EXPERIMENTAL SUPPORT FOR THEORETICAL COHERENT X-RAY SCATTERING FACTORS
Leif V. Singman 2 Mar. 1970 19 p refs Sponsored by AEC
(EGG-1183-1488; L-978) Avail: NTIS

Theoretical coherent X-ray scattering factors were found to be supported by experimental data. First, the success of X-ray crystal structure analysis would not have been possible without reliable atomic scattering factors calculated from theory. Second, a considerable number of experimental determinations of atomic scattering factor curves was made, some having very close agreement with theory.
Author (NSA)

N71-38991# Laboratoire de Physique Theorique et des Hautes Energies, Orsay (France).
ELECTROPRODUCTION OF NUCLEON ISOBARS IN THE QUARKS MODEL
A. Le Yaouanc, L. Oliver, O. Pene, and J. C. Raynal Jun. 1971 44 p refs
(LPTHE-71/20) Avail: NTIS

The hypothesis of electroproduction of N* in the quark model developed by N.S. Thornber, using the symmetric harmonic oscillator quark model is studied. Encouraging results were obtained for small q(2), but there was a strong disagreement for q(2) > or equal to GeV sq. not only for the absolute values but also for the ratio (d-sigma/d-Omega) (N*+)/(d-sigma/d-Omega). It is shown that this disagreement is mainly due to a bad choice of the frame where the nonrelativistic transition form factors are calculated and that there are physical reasons for choosing a frame near the Breit frame. The quark form factor is introduced which is needed by the various other successes of the symmetric oscillator quark model (spectroscopy, strong and electromagnetic widths, differential photoproduction, elastic and diffractive processes). The origin of this quark form factor is discussed due to either static charge distribution or mediating particle. The absolute magnitude, is attributed to the discrepancy between the dipole and gaussian form factors to relativistic corrections as suggested by others.
Author

N71-38992# Laboratoire de Physique Theorique et des Hautes Energies, Orsay (France).
A NOTE ON CORRELATIONS
B. d'Espagnat Jul. 1971 4 p refs
(LPTPE-71/42) Avail: NTIS

Correlations between observables pertaining to two different systems are investigated. Cases are singled out in which it is shown that these observables are uncorrelated. As an example, the production of a spin 3/2 particle in a two body reaction is considered.
Author

N71-38993# Research Inst. of National Defence, Stockholm (Sweden).
INVESTIGATION OF RADIOLYTIC EVOLUTION OF GAS IN THE STORAGE OF MATERIAL CONTAINING PLUTONIUM [UTREDNING BETRAEFFANDE RADIOLYTISK GASUTVECKLING VID FOERVARING AV PLUTONIUMHALTIGT MATERIAL]
B. Oesterdahl Mar. 1970 9 p refs In SWEDISH
(FOA-4-C-4419-24) Avail: NTIS

The radiolytic evolution of gas in the storage of material containing plutonium is discussed. Gases and solid waste which result from the radioactive decomposition of water containing plutonium by alpha radiation from the plutonium are determined empirically. Safety hazards which can be created by radiation of the physically or chemically bound water are described.
Author

N71-38994# California Univ., Berkeley. Lawrence Radiation Lab.
CHARGED PION PRODUCTION IN PROTON-PROTON INTERACTIONS BETWEEN 13 AND 28.5 GeV/c

Dennis Baird Smith (Ph.D. Thesis) Mar. 1971 109 p refs
(Contract W-7405-eng-48)
(UCRL-20632) Avail: NTIS

Multiparticle production is examined using 40,000 inelastic proton-proton interactions seen in hydrogen bubble chamber at five incident beam momenta: 13, 18, 21, 24, and 28.5 GeV/c. Cross sections are presented for various inelastic topologies. Using the sample of positively charged track momenta, it is found that one can estimate both the pion (+) and proton momentum distributions. The cross sections for pion (-) production in the reaction pp yields pion (-) + anything are given. For small values of pion (-) laboratory momentum, it is found that the pion (-) production differential cross section is independent of beam energy, indicating that the hypothesis of limiting fragmentation already holds at these energies. The transverse and longitudinal center-of-mass momentum distributions of both pion (+)'s and pion (-)'s are given for each inelastic topology and for each beam momentum. One parameter functions successfully describe each distribution. Author (NSA)

N71-35995# Westinghouse Electric Corp., Madison, Pa. Advanced Reactors Div.
EVALUATION OF SODIUM CROSS SECTIONS FOR ENDF/B Status Report
N. C. Paik and T. A. Pitterle Feb. 1971 18 p refs
(Contract AT(30-1)-4181)
(WARD-4181-2) Avail: NTIS

The status of the evaluation of the total, scattering, and reaction sections of Na-23 for ENDF/B is examined. Detailed curves of the total cross section from 100 eV to 15 MeV are given. NSA

N71-35996# Idaho Nuclear Corp., Idaho Falls.
RAFFLE MONTE CARLO CODE AND ITS USE TO OBTAIN CORRELATED ESTIMATES OF COLLAPSED CROSS SECTIONS
W. E. Vesely, F. J. Wheeler, and R. S. Marsden [1971] 23 p refs Presented at Meeting on New Develop. in Reactor Math. and Appl., Idaho Falls, Idaho, 29 Mar. 1971 Sponsored by AEC
(CONF-710302-11) Avail: NTIS

Features of the code described include the use of uniform interval number tables by which no logs, sines, or cosines are ever computed during a neutron history; the flexibility of handling pointwise and multigroup cross section data; and the flexibility of having three scoring estimators instead of the usual one particular estimator. A correlation technique incorporated in RAFFLE is described, by which collapsed group cross sections and the complete group-to-group transfer matrices can be obtained. These collapsed group constants are analogous to those obtained from any cross section code and have the virtue of containing the exactness of the Monte Carlo technique. Particular applications are described to illustrate the RAFFLE code in general and to illustrate, in particular, the feasibility of obtaining group constants by means of Monte Carlo.
Author (NSA)

N71-35997# Argonne National Lab., Ill.
SURVEY OF APPROXIMATION PROCEDURES FOR THE NUMERICAL SOLUTION OF THE NEUTRON TRANSPORT EQUATION
Hans G. Kaper and Gary K. Leaf Apr. 1971 55 p refs
(Contract W-31-109-eng-38)
(ANL-7779) Avail: NTIS

Various methods for the numerical solution of the stationary one-group neutron transport equation are evaluated. Emphasis is on those methods that are applicable to transport calculations for multidimensional, heterogeneous reactor configurations under realistic boundary conditions; in particular, attention is focused on the formulation aspects of these approximate procedures. Synthesis techniques (spherical harmonics method, moment methods) and discrete-ordinates techniques are considered.
Author (NSA)

N71-35998# Sandia Corp., Albuquerque, N. Mex. Technical Libraries Reference Div.
ION IMPLANTATION: A SELECTIVE BIBLIOGRAPHY
Joann Mazzio May 1971 186 p refs Sponsored by AEC
(SC-B-710148) Avail: NTIS

This bibliography of titles and abstracts was selected primarily from the periodical literature. It covers the research on ion implantation from January 1967 through September 15, 1970. References are given to earlier studies that trace the historical development of ion-implantation technology.
Author (NSA)

N71-35999# California Univ., Livermore. Lawrence Radiation Lab.
RECENT CHANGES IN THE ASTRON FAST PULSING SYSTEM
Mark E. Smith 15 Apr. 1971 27 p refs Presented at 4th Symp. on Eng. Problems of Fusion Res., Washington, D. C., 20 Apr. 1971 Sponsored by AEC
(UCRL-73129; Conf-710418-6) Avail: NTIS

The hard-tube modulators used to charge the accelerator PFN's were changed to a resonant-charge system and completely rebuilt. While no comparative reliability records are available, it is obvious that the system is at least ten times more reliable than the old system. The pulse-to-pulse regulation of the system is not as good as hoped for, but it seems to be adequate for reasonable performance of the accelerator. The second major change was the building of a power supply for the core-reset system. The old system had relatively poor voltage regulation (15 or 20%). Two problems existed: the power supply and cabling system were inherently poorly regulated, and an already too small substation was shared with another pulsed load of comparable size. Instead of about 90 small power supplies, the system uses one large series-pass transistor supply, operated on its own 1.5-MVA substation. Author (NSA)

N71-36000# Johns Hopkins Univ., Baltimore, Md. Dept. of Physics.
RESEARCH IN THEORETICAL PHYSICS Annual Report, 1 Apr. 1970 - 31 Mar. 1971
Dec. 1970 15 p refs
(Contract AT(30-1)-4076)
(NYO-4076-14) Avail: NTIS

Research on the structure of hadrons is summarized covering purely hadronic and semileptonic processes. A list of publications is included. NSA

N71-36001# Laboratoire de Physique Theorique et des Hautes Energies, Orsay (France).
A DUAL MODEL FOR ANTIGAMMA NEUTRON YIELDS KAON ANTIKAON PION PION AT REST
J. Gabarro Jul. 1971 21 p refs
(LPTHE-71/40) Avail: NTIS

A study of the dual model, based on theoretical developments of the Veneziano formula, is presented. The model is obtained from a 6-point dual amplitude containing pion and kaon trajectories. Author

N71-36002# Texas Univ., Austin. Center for Particle Theory.
DEEP INELASTIC NEUTRINO-NUCLEON INTERACTIONS
Robert Beck Clark and Masao Yamada 10 Nov. 1970 11 p Sponsored in part by AEC and NSF
(ORO-3992-24) Avail: NTIS

Deep inelastic neutrino-nucleon interactions are discussed under the assumptions of conserved axial vector current and equal time commutation relations of currents. It is shown that the structure functions W1 and W2 for vector and axial vector currents are equal in the average sense with respect to the variable nu and are equal in the limit nu approaches infinity. The resulting expressions are then used to predict relations connecting deep inelastic neutrino and electron scattering.
Author (NSA)

N71-36003*# National Bureau of Standards, Boulder, Colo. Inst. for Basic Standards.
CRITICAL REVIEW OF ULTRAVIOLET PHOTOABSORPTION CROSS SECTIONS FOR MOLECULES OF ASTROPHYSICAL AND AERONOMIC INTEREST
R. D. Hudson Aug. 1971 110 p refs Repr. from Rev. Geophys. Space Phys., v. 9, no. 2, May 1971 Prepared in cooperation with Colorado Univ., Boulder
(Grant NGL-06-003-052; Contract DA-31-124-ARO(D)-139)
(NASA-CR-122098; NSRDS-NBS-38) Avail: SOD $1.00 CSCL 20H

Photoabsorption cross sections at wavelength less than 3000 A are discussed. A discussion of the relative merits of various experimental techniques is given along with possible systematic and random errors that may be associated with them. The problems in data analysis associated with finite spectral bandwidths are reviewed, with special emphasis on the interpretation of published absorption cross sections. The prepared figures are used to compare the results of several determinations or to point out where difficulties of interpretation might arise. Author

N71-36004# Texas Univ., Austin. Center for Particle Theory.
INDEFINITE METRIC AND SHADOW STATES IN QUANTUM FIELD THEORY
E. C. G. Sudershan Nov. 1970 13 p refs
(Contract AT(40-1)-3992)
(ORO-3992-30; CPT-81; AEC-30) Avail: NTIS

Fundamental questions in relativistic quantum field theories are discussed. It is argued that the introduction of states with negative norm provides a way out of the divergence difficulties in realistic quantum field theories. In order to assure the probability interpretation the concept of shadow states and ideas from an action-at-a-distance theory are introduced.
Author (NSA)

N71-36005# Case Western Reserve Univ., Cleveland, Ohio. Dept. of Physics.
SEARCH FOR A CP-NONCONSERVING ASYMMETRY IN THE DECAY K(0) SUB L INTO PION(PLUS) PION(MINUS) PION(0)
Lawrence B. Levit (Ph.D. Thesis) Jan. 1971 94 p refs Sponsored by AEC and Natl. Res. Council of Canada
(COO-1749-24) Avail: NTIS

The CP symmetry in the decay K(0) sub L yields pion(+) pion(-) pion(0). A search was made for a charge asymmetry revealing itself as a difference between the pion(+) and pion(-) transverse momentum spectra. The experimental configuration was three hodoscopes in line and a momentum analyzing magnet. The experimental limit set by this experiment was calculated from the data for which both charged gamma mesons were detected, and one gamma ray from the neutral pion decay was identified. This constitutes 400,000 events. The experimental data were analyzed by a Monte Carlo fitting procedure. The best value obtained for the CP violating parameter, was 0.0001 + or - 0.0009. Estimates of all biases that could mask the asymmetry are included in the uncertainty quoted above. Two previous experiments show no asymmetry to a precision of 0.02, and one experiment exhibited at 2 1/2 standard deviation effect of 0.04. The result of this experiment is consistent with CP invariance. Author (NSA)

N71-36006# Kansas Univ., Lawrence. Dept. of Chemistry.
SMALL-ANGLE SCATTERING OF X-RAYS FROM CARBON DIOXIDE IN THE VICINITY OF ITS CRITICAL POINT
Jar-Shyong Lin (Ph.D. Thesis) 1970 115 p refs Sponsored in part by AROD, NSF, and Petrol. Res. Fund
Avail: NTIS

A study was made to obtain measurements of the angular dependence of scattered X-ray intensity from carbon dioxide near its critical point. It was found that the reciprocal of scattered intensity varies linearly with the scattering angle squared, over a specified range, and along the liquid side of the coexistence curve. The relative isothermal compressibility and long-range correlation length were computed, and the values of critical exponents were obtained. The experimental results are presented along with a discussion of the theory involved. In addition, descriptions are given of the instrumentation and data treatment. D.L.G.

N71-36007# General Electric Co., Sunnyvale, Calif. Breeder Reactor Development Operation.
SYN: OPERATIONAL ASPECTS OF THE COMBINED BISYN, PERT, AND BICYCL SYNTHESIS CODES
M. D. Kelley Dec. 1970 193 p refs
(Contract AT(04-3)-189)
(GEAP-13672) Avail: NTIS

The BISYN segment of SYN solves the two-dimensional multigroup neutron diffusion theory equations in r,z or x,y geometry using a noniterative synthesis method. This approach is designed to greatly reduce the computer cost of running two-dimensional multigroup problems at the risk of some loss in accuracy of the detailed flux distribution. This segment also contains a perturbation and effective delayed neutron fraction calculation. The BICYCL segment of SYN uses output from BISYN to solve the one-group neutron depletion equations. BICYCL allows the user to search on makeup or recycle isotopic compositions for a first cycle of a first core or for equilibrium concentrations. It also has provisions for fuel shuffling and the option to cycle back to BISYN in order to update the fluxes and one-group cross sections. Author (NSA)

N71-36008# Oak Ridge National Lab., Tenn.
NEUTRON MULTIPLICITY FOR Pu-239 RESONANCE FISSION
L. W. Weston and J. H. Todd Apr. 1971 12 p refs Presented at 3d Conf. on Neutron Cross Sect. and Technol., Knoxville, Tenn., 15 Mar. 1971
(Contract W-7405-eng-26)
(ORNL-TM-3331; Conf-710301-14) Avail: NTIS

Measurements were carried out in an attempt to resolve the discrepancy in the spin dependence of the fission-neutron multiplicity for resonances in Pu-239. Fission neutrons from a fission chamber were detected with low efficiency by using fast-neutron detectors rather than counting with high efficiency by using thermal-neutron detectors. The data do not indicate any statistically significant separation into two groups of multiplicity values according to spin state of the resonance between 14 and 200 eV. Author (NSA)

N71-36009# California Univ., Livermore. Lawrence Radiation Lab.
STRUCTURE IN THE U-235 keV FISSION CROSS SECTION
C. D. Bowman, G. S. Sidhu, M. L. Stelts, and J. Browne 11 Mar. 1971 9 p refs Presented at 3d Conf. on Neutron Cross Sect. and Technol., Knoxville, Tenn., 15 Mar. 1971 Sponsored by AEC
(UCRL-73090; Conf-710301-11) Avail: NTIS

The structure in the keV fission cross section, which was previously reported, has been remeasured using the 250 meter flight path at 100 MeV electron linac. The resolution is nominally about 0.15 nsec/meter. Author (NSA)

N71-36010# California Univ., Berkeley. Lawrence Radiation Lab.
EXPERIMENTS ON ACCELERATION OF ALPHA PARTICLES BY THE COLLECTIVE METHOD
V. P. Sarantsev et al Feb. 1971 19 p refs Transl. into ENGLISH of Russian report JINR-P9-5558
(UCRL-Trans-1434; JINR-P9-5558) Avail: NTIS

The results of experiments on alpha-particle acceleration by the collective method in the adgezator and the technique of alpha-particle detection are presented. Author (NSA)

N71-36011# Kyoto Univ. (Japan). Research Inst. for Fundamental Physics.
LOW ENERGY THEOREMS AND NEUTRINO-NUCLEON SUM RULES
Nigel C. McKenzie Jul. 1971 28 p refs
(RIFP-127) Avail: NTIS

Low energy theorems are derived for the Compton-type scattering of combinations of the strangeness nonchanging vector and axial vector currents. These are then used to obtain new sum rules for neutrino nucleon cross sections at Q sq = 0. Author

N71-36012# Harry Diamond Labs., Washington, D.C.
TRIPLY IONIZED NEODYMIUM IN LITHIUM YTTRIUM FLUORIDE
D. E. Wortman Jun. 1971 20 p refs
(AD-726360; HDL-TR-1554) Avail: NTIS CSCL 07/4

Absorption spectra of Nd(3+) in single-crystal LiYF4 have been measured at 25 and 85 K for the purpose of establishing the quadruplet I(13/2) and quadruplet I(15/2) ground-term energy levels. These energy levels and those published previously for the quadruplet I(9/2) and quadruplet I(11/2) multiplets were compared with theoretical energy levels. An rms deviation of 3.87/cm was obtained between calculated and experimental energy levels. Comparisons of the spin-orbit parameters, the lamda(n), with earlier work concerning Nd(3+) in CaWO4 suggests that the lambda(n) adequately describe the splitting of the free-ion energy levels. Therefore, these B(km) values might be expected to describe the effect of the crystal on the free-ion energy levels. In addition, calculated g factors for all the energy states of the ground term are given. Author (GRA)

N71-36013# California Univ., La Jolla. Dept. of Chemistry.
DECAY OF CORRELATIONS. 4: NECESSARY AND SUFFICIENT CONDITIONS FOR A RAPID DECAY OF CORRELATIONS
Dick Bedeaux, Kurt E. Shuler, and Irwin Oppenheim (MIT, Cambridge) 1971 39 p refs Sponsored in part by NSF
Prepared in cooperation with MIT, Cambridge
(Contract N00014-69-A-0200-6018; ARPA Order 1479)
(AD-726762; TR-8) Avail: NTIS CSCL 07/4

The authors consider N particle systems whose probability distributions obey the master equation. For these systems, the authors derive the necessary and sufficient conditions under which the reduced n particle (n + N) probabilities also obey master equations and under which the Ursell functions decay to their equilibrium values faster than the probability distributions. These conditions impose restrictions on the form of the transition rate matrix and thus on the form of its eigenfunctions. The authors first consider systems in which the eigenfunctions of the N particle transition rate matrix are completely factorized and demonstrate that for such systems the reduced probabilities obey master equations and the Ursell functions decay rapidly if certain additional conditions are imposed. As an example of such a system the authors discuss a random walk of N pairwise and interacting walkers. The authors then demonstrate that for systems whose N particle transition matrix can be written as a sum of one particle, two particle, etc. contributions, and for which the reduced probabilities obey master equations, the reduced master equations become in the thermodynamic limit those for independent particles, which have been discussed previously. As an example of such N particle systems the authors discuss the relaxation of a gas of interacting harmonic oscillators. Author (GRA)

N71-36014 California Univ., Berkeley.
STUDY OF PION(MINUS) PLUS PROTON YIELDS LAMBDA HYPERON PLUS KAON(0) FROM 944 MeV/c TO 1170 MeV/c
Joseph Cecil Doyle (Ph.D. Thesis) 1969 166 p
Avail: Univ. Microfilms Order No. 70-1757

The process pion(-) + proton yields Lambda hyperon + kaon(0) has been studied at incident beam momenta of 944, 968, 986, 991, 1006, and 1170 MeV/c in a 72-inch hydrogen bubble chamber. Differential and total cross sections and polarizations are presented. An attempted partial-wave analysis incorporating data at 1030 MeV/c is described and two solutions found. Dissert. Abstr.

N71-36015 Louisiana State Univ., Baton Rouge.
FREE-FREE ABSORPTION COEFFICIENT OF THE NEGATIVE HYDROGEN ION
Jerry Lee Stilley (Ph.D. Thesis) 1970 101 p
Avail: Univ. Microfilms Order No. 70-18562

The dipole adiabatic exchange wave functions of polarized orbital theory have been employed to obtain the S yield P and P yields D contributions to the free-free absorption coefficient of negative hydrogen in the dipole length and dipole velocity formulations. The length and velocity results were found to be in good agreement, 3% or less at the longer wavelengths were free-free absorption dominates bound-free absorption. These results are in good agreement with other recent calculations and with solar observations. The effects of atomic distortion were found to be small at longer wave-lengths (1% for length formulation and 6% for velocity formulation) making inclusion thereof relatively unimportant for astrophysical applications. Asymptotic matrix elements which are convergent over all space reproduce the full results to within 10%. Dissert. Abstr.

N71-36016 Alabama Univ., University.
A STUDY OF RADIATION PRODUCED BY HIGH ENERGY ELECTRONS IN A DISK-LOADED WAVEGUIDE
William Raymond Mahaffey (Ph.D. Thesis) 1970 46 p
Avail: Univ. Microfilms Order No. 70-17941

A theoretical investigation of a disk-loaded waveguide excited by a delta-function and an RF bunched pulsed electron beam gives quantitative results which can be used to estimate the strengths of interactions obtainable in experimental configurations. Results are presented for the radiation emitted when a fast beam is in close synchronism with the fundamental azimuthally-symmetric space harmonic. The effects of beam velocity and diameter are illustrated. Dissert. Abstr.

N71-36017 Michigan State Univ., East Lansing.
GAMMA RAY SPECTROSCOPY STUDIES OF THE EXCITED STATES OF ODD PROTON (ODD MASS) NUCLEI IN THE Z EQUALS 50 - 62, N EQUALS 64 - 82 REGION
Dwight Beecher Beery (Ph.D. Thesis) 1969 196 p
Avail: Univ. Microfilms Order No. 70-14988

The beta, gamma decay schemes of Nd-141(m + g), Nd-139(m + g), Ce-137(m + g), Ba-133(m), and Ba-131(m) were studied in an effort to acquire information about the energy level systematics in this region of the table of nuclides. Ge(Li) singles and Ge(Li)-NaI(Tl) coincidence spectrometers were employed to identify and establish the sequence of many new gamma ray transitions. Some significant additions to and changes from previously proposed schemes are suggested by the data. A survey was made of all the energy state systematics of the low energy levels of odd proton (odd mass) nuclides in the Z = 50 to 62, N = 64 to 82 region. From these observations, some predictions and suggestions for future experiments were made. Dissert. Abstr.

N71-36018 Texas Univ., Austin.
REPRESENTATIONS OF LOCAL CURRENTS AND RELATED ALGEBRAS
Rui Vilela de L. Mendes (Ph.D. Thesis) 1970 120 p
Avail: Univ. Microfilms Order No. 70-18270

A representation of current algebra emphasizing infinite parameter Lie algebras is proposed. A class of irreducible Hermitean representations of the algebra of I-spin charge densities is studied. States of well defined momentum and angular momentum properties are constructed using translational and rotational invariance and forming direct integral spaces. The

representations belong to two distinct subclasses, distinguished by vanishing or nonvanishing of a length parameter. Invariant form factors are derived by choosing a particular frame to insure covariances of the results. The results are then applied to two other algebras: For the canonical commutation relations of uncharged scalar fields, a classification is obtained of the representations in an infinite number of classes completely characterized by systems of functional equations. For the algebra of fields (restricted to isospin), a negative result is proved forbidding a nontrivial representation of Schwinger terms in spaces that are direct sums of representations of the integrated subalgebra. Dissert. Abstr.

N71-36019 Rochester Univ., N.Y.
CONTINUOUS MOMENT SUM RULES
Yu-Chien Liu (Ph.D. Thesis) 1970 182 p
Avail: Univ. Microfilms Order No. 70-17893

The problem consists of putting the real part of the scattering amplitude on an equal footing with the imaginary part, with both appearing in the physical region, and introducing a continuous parameter and therefore an infinite number of sum rules which contain both ordinary and inverse dispersion relations as special cases. The sum rule can be used to determine low energy parameters (coupling constants, scattering lengths) as well as high energy ones (Regge trajectories, residues). Theory is developed for forward pion-nucleon scattering. Extensions to nonforward directions as well as to other interesting processes (single pion-photoproduction, nucleon-nucleon scattering, proton Compton scattering, and pion-pion scattering) are discussed. A detailed presentation is made for the kinematics of each process. Dissert. Abstr.

N71-36020 Rochester Univ., N.Y.
STUDY OF INTERFERENCE BETWEEN AMPLITUDES FOR K SUB L DECAYS INTO 2 NEUTRAL PIONS AND K SUB S DECAYS INTO 2 NEUTRAL PIONS
Daniel Raymond Green 1970 136 p
Avail: Univ. Microfilms Order No. 70-17882

The proper time dependence of the decays K yields pion(+) pion(-) and K yields pion(0) pion(0) over a proper time interval of 2 to 8 K sub S lifetimes. Kaons, neutral K or neutral antikaons, were produced by charge exchange of a K(+) or K(-) beam with a momentum of 2 BeV/c. Charge and neutral decays were simultaneously detected in a system of spark chambers. No statistically significant difference in the proper time dependence of the charged and neutral decay modes was observed. This result has implications for the structure of the CP violating interaction. Alternatively, it was concluded that the amplitude for the CP violating decay K sub L yields 2 pion, with the final state pions having total isotopic spin = 2, is, at most, 35% of the analogous decay amplitude with isotopic spin = 0.
Dissert. Abstr.

N71-36021 Minnesota Univ., Minneapolis.
A STUDY OF THE (He3,t) REACTION AND ISOBARIC ANALOG STATES IN 1f-2p SHELL NUCLEI
Frederick Daniel Becchetti, Jr. (Ph.D. Thesis) 1969 84 p
Avail: Univ. Microfilms Order No. 70-15700

The reaction leading to isobaric analog and other states in the Ti, Fe, Ni, and Zn isotopes is studied at an incident He-3 energy of 24.6 MeV, using a magnetic spectrometer and position-sensitive detectors. The (He-3,t)Q values measured are used to extract Coulomb displacement energies accurate to plus or minus 6 KeV or less. The zero(plus) to zero(plus) analog strength in several nuclei with T greater than 1 appears to be shared by several states. Two cases in particular, Fe-58/Co-58 and Fe-58/Co-58, are studied further, using (deuteron, alpha) and other reactions. The results suggest large isospin mixing for these nuclei. The Coulomb displacement energies and differential cross sections are analyzed using current macro- and microscopic models. Information about the nuclear neutron excess and the (He-3,t) reaction mechanism is obtained. A global optical model analysis of published He-3 and triton elastic scattering is also presented. Dissert. Abstr.

N71-36022 Rochester Univ., N.Y.
THE SEMICLASSICAL APPROACH TO NONREACTIVE SCATTERING AND APPLICATION OF THE METHOD OF HARRIS, ENGERHOLM AND GWINN TO QUANTUM PHYSICS
David Jerome Locker (Ph.D. Thesis) 1970 168 p
Avail: Univ. Microfilms Order No. 70-17894

Calculation of the Hamiltonian matrix elements for one-dimensional Fues and cubic oscillators is discussed. Both sine and harmonic oscillator basis sets are used to calculate expansion coefficients and eigenvalues. The quantum dynamics of these oscillators is studied by wave packet analyses. Good normalization is found to be a necessary but not sufficient condition for accurate coordinate expectation values as a function of time. The N-state semiclassical approach is used in the calculation of transition probabilities for atom-diatomic molecule collinear collisions. Two intramolecular potentials for the diatomic molecule are studied: the quadratic potential and the Morse potential. For the Morse and harmonic oscillators, transition probabilities are strongly dependent upon the initial phase. Transition probabilities obtained by matching the Morse potential with the quadratic potential indicate that the potentials should be matched on their repulsive sides, rather than at their minimum. Dissert. Abstr.

N71-36023 Colorado Univ., Denver.
THE (He-3, d) STRIPPING REACTION ON MEDIUM WEIGHT NUCLEI
Marvin Eugene Cage (Ph.D. Thesis) 1969 119 p
Avail: Univ. Microfilms Order No. 70-16470

With the availability of thick solid state detectors, and improvements in their resolution, it has become possible to perform detailed studies of proton stripping processes via the (He-3,d) reaction. This reaction can be used to study the proton particle-hole pair states of closed shell nuclei. Since these states can be interpreted simply in terms of the nuclear shell model, the experiment provides an excellent opportunity for the comparison between existing theoretical predictions and the experimental results. Dissert. Abstr.

N71-36024 Kansas State Univ., Manhattan.
INTERNAL CONVERSION PROCESSES FOR ELECTRIC QUADRUPOLE TRANSITIONS IN THE DEFORMED NUCLEAR REGION
Donald Eugene Burton (Ph.D. Thesis) 1970 285 p
Avail: Univ. Microfilms Order No. 70-16821

Calculations are made in the no-penetration approximation using the relativistic Hartree-Fock atomic model with the inclusion of static finite-nuclear-size effects. Results are presented for Gd-152, Gd-154, Gd-158, Dy-160, Er-166, Yb-172, Os-186, Os-188, Os-192, and Hg-193. Comparison of the present calculations with the weighted averages of the available experimental values indicates that substantial discrepancies exist between the two. It is shown that most of these can be accounted for on the basis of either (1) dynamic E2 penetration effects or (2) parity-nonconserving nuclear forces. In the first case, it is found that the dynamic E2 penetration parameters must be several times the values predicted by the surface-current model. If, on the other hand, parity-nonconserving nuclear forces are the cause of the discrepancies, then conversion electron on longitudinal polarization of 5 to 30 percent can be expected. Dissert. Abstr.

N71-36025 California Univ., Berkeley.
A STUDY OF THE REACTION PION(PLUS) DEUTERON YIELDS (PROTON) PROTON PION(PLUS) PION(MINUS) PION(0) AT INCIDENT PION MOMENTA BETWEEN 1.1 AND 2.4 BeV/c
Jerome Samuel Danburg (Ph.D. Thesis) 1969 172 p
Avail: Univ. Microfilms Order No. 70-13033

The reaction was studied in a 294,000-picture bubble chamber experiment with pion beam momentum between 1.1

and 2.4 BeV/c. The most significant features of the final state are production of eta mesons and omega mesons in the reactions pion(+) neutron yields eta meson proton, and pion(+) neutron yields omega meson proton. The eta meson production characteristics are well described by a Reggeized A2 exchange model using Veneziano type residue functions. The omega meson production and decay characteristics are presented, and it is found that a rho meson exchange model with absorptive corrections is inadequate to describe the data. Dissert. Abstr.

N71-36026 New Mexico Univ., Albuquerque.
FISSION BARRIERS AND TRANSITION-STATE SPECTRA FOR Th-232, Th-234, U-238, (t,pf) REACTIONS
James D. Cramer (Ph.D. Thesis) 1969 122 p
Avail: Univ. Microfilms Order No. 70-16382

Angular correlations of fission fragments obtained in these experiments provide information about the low-lying collective excitations or transition states at the fission barrier. The (t,p) reaction leads to neutron-rich residual nuclei unobtainable by other methods. The absence of spin coupling for (t,p) reactions on even-even targets provides angular distributions with well-defined structure in the region of the fission barrier. The data were fitted to a series of even Legendre polynomials, and the results exhibit well-defined structure in the angular coefficients which correlates with structure in the fission probability for most of the nuclei studied. Characteristics of transition state spectra and fission barrier shapes are presented with respect to variations of the fissility parameters. This survey of the fission properties of several nuclei indicates some general trends relating the saddle point deformation to the character of the transition level structure. Dissert. Abstr.

N71-36027 California Univ., Riverside.
MANY-BODY THEORY FOR PROPERTIES OF INTERACTING ATOMS
Chizuko Matsubara Dutta (Ph.D. Thesis) 1969 137 p
Avail: Univ. Microfilms Order No. 70-19232

Many-body perturbation procedure was applied to study various properties of interacting atoms, utilizing the response functions of individual atoms to time dependent external fields. The frequency dependent polarizabilities of hydrogen, helium and neon were calculated. The results were compared with earlier work and experiments. Also, various excitation energies and ionization energies were obtained from the singularities of alpha(omega) functions. They are uniformly in good agreement with experiments, the error being less than 0.75% for the case of helium and less than 7% for neon. A formulation for calculating fractional frequency shifts of the hyperfine interaction of a paramagnetic atom in rare gas atmosphere was carried out by a similar approach, using appropriate response functions besides alpha(omega). Application was made to H-He and H-Ne systems. Dissert. Abstr.

N71-36028 Nebraska Univ., Lincoln.
ABSOLUTE DOUBLY DIFFERENTIAL IONIZATION CROSS SECTIONS FOR Ne(PLUS) - Ne AND Ar(PLUS) - Ar COLLISIONS
Robert Kent Cacak (Ph.D. Thesis) 1970 204 p
Avail: Univ. Microfilms Order No. 70-17909

The cross sections were doubly differential in both angle and energy of the ejected electrons. The energy range of the ions was 50 keV to 300 keV. The angle that the detector-analyzer assembly made with ion beam was variable, and the assembly's position determined the angle at which the electrons were observed. An absolute cross section was determined. The experimental results are compared with the prediction of the Fano-Lichten electron promotion model, and the consequences of the model agree with the experimental results. Calculations based on the results of the Russek statistical evaporation model are also compared with experiment. A simple model for Auger excitation is compared to the cross section for Auger electron emission, and the results tend to support the Fano-Lichten model. Dissert. Abstr.

N71-36029 Indiana Univ., Bloomington.
NUCLEAR MAGNETIC RELAXATION IN GASEOUS HYDROGEN AND MIXTURES OF HYDROGEN WITH HELIUM
Santiago Pinto Vega (Ph.D. Thesis) 1970 94 p
Avail: Univ. Microfilms Order No. 70-14968

The spin-lattice relaxation times of H2 and mixtures of H2 with helium were measured at 77 K as a function of number density for a number of helium compositions. Standard spin-echo techniques were used to measure the relaxation times. The measured values of the relaxation time were fitted with theoretical expressions, assuming that the relaxation is due to intramolecular dipole-dipole and spin-rotational interactions. The calculated and experimental values for each helium composition agree quite well. Dissert. Abstr.

N71-36030 Carnegie-Mellon Univ., Pittsburgh, Pa.
AN ANGULAR MOMENTUM DECOMPOSITION OF THE THREE BODY PROBLEM
Joseph George Depp (Ph.D. Thesis) 1970 96 p
Avail: Univ. Microfilms Order No. 70-17139

A formalism is developed which enables the use of an anti-symmetrized potential in the calculation of three-body contribution to the binding energy per particle of nuclear matter. An angular momentum decomposition is done in the center of mass of the three particle system. A three-body angle-averaged Pauli operator is also developed and utilized. Appropriate numerical approximations are introduced and the numerical methods used are discussed. The calculation was performed using the Reid soft-core potential. At normal density a repulsive contribution of 2.913 Mev is obtained for the binding energy per particle. Dissert. Abstr.

N71-36031 Cornell Univ., Ithaca, N.Y.
EPICADMIUM INTEGRAL FISSION CROSS SECTION MEASUREMENTS FOR TWELVE HEAVY NUCLIDES
Ernest Linn Draper (Ph.D. Thesis) 1970 140 p
Avail: Univ. Microfilms Order No. 70-14377

The measured and calculated fission rates differed by less than 7% for Th-232, U-233, U-235, U-236, U-238 and Np-237. There is evidence that the Th-232, U-238, and Np-237 data need slight normalization corrections. Pu-239 showed positive deviations from calculated activities of from about 4 to 10% depending on the spectrum. Pu-240 had measured fission rates from 7.5 to 12% greater than calculated while Pu-241 measurements ranged from about 6 to 10% lower than calculated. The Am-241 had a substantial deviation only in the softest spectrum indicating a possible differential cross section error in the eV region. The Am-242m had large positive deviations from calculated activities in all spectra but nonuniformity of the deposit made it impossible to specify the reason for these deviations. Am-243 had measured fission rates approximately 60% higher than calculated in all spectra. Dissert. Abstr.

N71-36032 Wisconsin Univ., Madison.
LOW MOMENTUM ANTIPROTON-PROTON SCATTERING
Jane Butterfield English (Ph.D. Thesis) 1970 61 p
Avail: Univ. Microfilms Order No. 70-13912

The results from a study of antiproton-proton interactions between 100 MeV/c and 750 MeV/c. A total of 125,000 pictures were taken in the hydrogen filled 30 inch bubble chamber. Two classes of events were studied, backward hemisphere elastic scattering and very low momentum annihilation events coming from antiprotons that had already scattered elastically. For the annihilation events 0, 2, 4 and 6 prong cross sections were measured from 100 MeV/c to 550 MeV/c. All these cross sections fall steeply from 100 MeV/c to 300 MeV/c, then with a rather abrupt break fall less sharply from 300 MeV/c to 550 MeV/c. The differential elastic cross section was measured from 250 MeV/c to 750 MeV/c. When displayed as d sigma/d omega vs. momentum for different center of mass cosine (cos theta) cuts a broad bump shown at

550 MeV/c for data with cos theta less than -.6. Comparison of the data with previous experiments 1,3,4,5,6,7 lends some support for the existence of two resonances with masses 1927 MeV and 1950 MeV and widths 10 MeV and 50 MeV respectively. The 1927 is at least L = 3. Dissert. Abstr.

N71-36033 Pennsylvania State Univ., University Park.
THREE-DIMENSIONAL FIELD EMISSION IN THE PERTURBED SCATTERING MODEL
Jay Lester Politzer (Ph.D. Thesis) 1969 118 p
Avail: Univ. Microfilms Order No. 70-19450

A three-dimensional Green's function solution is obtained for field emission from a spherical tip with arbitrary perturbative potentials. The unperturbed problem is a spherical well, representing the tip, with a Coulomb barrier outside the tip, and is solved exactly. The formulation is in terms of scattering theory, and a differential scattering probability is used to replace the usual transmission coefficient. Statistical averaging is accomplished without recourse to kinetic arguments which are shown to be generally invalid. A simple expression for the perturbed energy distribution is obtained. The perturbed distribution is the unperturbed distribution multiplied by energy and angle dependent pre-factors. The pre-factors are related to radial integrals of the perturbation and may be deduced from experiments which measure the angular distribution of field emitted electrons. Dissert. Abstr.

N71-36034 Rochester Univ., N.Y.
A STUDY OF DIFFRACTIVELY PRODUCED THREE-BODY FINAL STATES IN K(PLUS)p INTERACTIONS AT 13 GeV/c
Morton S. Farber (Ph.D. Thesis) 1970 232 p
Avail: Univ. Microfilms Order No. 70-17876

Results are presented for a study of the four-pronged topology produced in kaon(+)-proton interactions, using an 80-inch hydrogen-filled bubble chamber. The reactions discussed in detail are: (1) kaon(+)proton yields kaon(+) proton pion(+) pion(-); (2) kaon(+) proton yields kaon(+) proton pion(+) pion(-) pion(0); and (3) kaon(+) proton yields kaon(+) proton kaon (+) kaon (-). Reaction (1) proceeds largely via quasi-three-body production leading to the final states kaon(+) rho meson(0) proton, pion(+) kaon*(890) proton, kaon(+) pion(-) Delta hyperon(++)(1236) and is characterized by large low-mass enhancements in the kaon(+) pion(+) pion(-) and proton pion(+) pion(-) systems. Using reactions (2) and (3) the three-body states kaon(+) omega meson(0) proton, kaon(+) eta meson(0) proton, and kaon(+) phi meson(0) proton were studied. A prominent feature in these reactions is low-mass enhancement. This was also observed in the proton omega meson(0) and proton eta meson(0) systems. These enhancements indicate diffraction phenomena. Dissert. Abstr.

N71-36035 Colorado Univ., Boulder.
ANGULAR DEPENDENCE OF MOLECULAR DISSOCIATION PROCESSES PRODUCED BY ELECTRON IMPACT
Richard J. Van Brunt (Ph.D. Thesis) 1969 158 p
Avail: Univ. Microfilms Order No. 70-16528

Angular and energy distributions of H(+), D(+), N(+), and O(-) produced by electron bombardment of H2, D2, N2, and O2 were observed. An observed shift in the velocity distribution of H(+) and D(+) measured at corresponding forward and backward angles with respect to the electron beam is interpreted in terms of molecular recoil. Angular and energy distribution as well as appearance potential measurements of N(+) indicate that many repulsive states contribute to dissociative ionization of N2 for electron energies above 40 eV. The angular distribution of O(-) from dissociative attachment of O2 shows a strong energy dependence. The angular distribution of 2.0 eV O(-) which was produced at 30 eV by the process of ion pair formation is strongly peaked at forward and backward angles. Atomic fluorescence excited by molecular dissociation can be polarized and the degree of polarization is related to the form of the anisotropy in the angular distribution of dissociation products. Dissert. Abstr.

N71-36036 Clemson Univ., S.C.
APPLICATION OF THE QUANTUM MECHANICAL THREE BODY PROBLEM TO THE STUDY OF NONLINEAR, TRIATOMIC MOLECULES
George Francis Adams (Ph.D. Thesis) 1969 82 p
Avail: Univ. Microfilms Order No. 70-17443

The Hamiltonian operator derived by Freed and Lombardi is simplified and transformed in order to study the vibration-rotation states of the general, nonlinear triatomic molecule. A potential energy function which possesses a barrier at the linear configuration and has a minimum associated with the equilibrium configuration was used. Schroedinger's method is used in order to obtain the vibrational and rotational eigenvalues for the series of nitrosyl bromide. The solution of the differential equation is obtained by expanding the wave function as a Frobenius series. Eigenvalues are obtained from the resulting four-term recursion relation by a method utilizing Hill's determinant. The results obtained for the rotational and vibrational energy level spacings are in excellent agreement with the observed transitions. Dissert. Abstr.

N71-36037 Kentucky Univ., Lexington.
THE (NEUTRON,NEUTRON' GAMMA) REACTIONS AS A TOOL FOR NUCLEAR SPECTROSCOPY NEAR A EQUALS 70 AND AT A EQUALS 27
Kuo-ching Chung (Ph.D. Thesis) 1969 64 p
Avail: Univ. Microfilms Order No. 70-16965

Several (neutron, neutron'gamma) experiments have been performed on four even-A Ge isotopes and on Al-27 by pulsed beam time-of-flight techniques with a Ge(Li) detector. The 90 deg excitation functions of the gamma-ray transitions in the Ge(neutron, neutron'gamma) reactions were measured at incident neutron energies from 0.5 to 2.55 MeV. Angular distributions at En=1.75, 2.13 and 2.55 MeV were also measured. The gamma-ray production cross sections and the neutron inelastic scattering cross sections were obtained at these neutron energies. Theoretical calculations were performed and are in good agreement with the experimental results. The Wolfenstein-Hauser-Goehbach formalism was used for the calculations. The low-lying decay schemes of the four even-A Ge isotopes determined are in good agreement with previous investigations. Branching ratios and mixing ratios of the gamma-ray decay from the second 2+ state for all the four even-A isotopes have been obtained. In addition, a test of the necessity for fluctuation corrections to the statistical model at mass region near A=70 has been made. Dissert. Abstr.

N71-36038 Colorado Univ., Boulder.
A LASER STUDY: ABSOLUTE SPECTRAL INTENSITIES FROM THE TRANSITION e 3 SIGMA g TO b 3 SIGMA u IN MOLECULAR DEUTERIUM AND HYDROGEN EXCITED BY PULSE DISCHARGE
Robert Charles Bigelow (Ph.D. Thesis) 1969 297 p
Avail: Univ. Microfilms Order No. 70-16466

A special derivation of laser theory circumvents the problems caused by the extremely broad line width of the continuum spectrum and by the unobservable emission at wavelengths below 2000 A. The exact oscillation condition and gain per meter equation are derived in terms of partial state densities. An argument based on experimental evidence from the literature shows that the molecular states 3 pi u is metastable with a lifetime in the millisecond range for vibrational levels higher than the first. At and above five Torr, the present experiments prove that no appreciable radiation takes place into the continuum from c 3 pi u after the first two hundred nanoseconds. The average pulse emission data does not agree with data obtained by peak reading the pulse. When both kinds of data are normalized together at 2400 A, the peak readings are higher at both extremes of the spectrum than are the average readings. Higher vibrational states in a 3 sigma g may be more strongly excited during the current peak than on the average. Dissert. Abstr.

N71-38039 National Bureau of Standards, Washington, D.C. Office of Standard Reference Data.
SELECTED TABLES OF ATOMIC SPECTRA. A: ATOMIC ENERGY LEVELS, SECOND EDITION. B. MULTIPLET TABLES, N IV, N V, N VI, N VII. DATA DERIVED FROM THE ANALYSES OF OPTICAL SPECTRA
Charlotte E. Moore Aug. 1971 42 p
(NSRDS-NBS-3-Sect-4) Copyright. Avail: SOD $0.55

Data tables on atomic spectra as derived from analyses of optical spectra are presented. Part A contains the atomic energy levels and part B the multiplet tables. Four spectra of nitrogen, N IV,V,VI, and VII are included. Author

N71-38040 California Univ., Berkeley.
CONDUCTION ELECTRON SPIN RESONANCE STUDIES IN SODIUM
William Frederick Kolbe (Ph.D. Thesis) 1969 72 p
Avail: Univ. Microfilms Order No. 70-17597

Conduction electron spin resonance in metals is characterized by an asymmetrical lineshape resulting from the diffusion of electrons in and out of the microwave skin region. If the transport relaxation time, at low temperatures is sufficiently long to satisfy the cyclotron resonance condition, the spin diffusion length becomes a function of the direction of the applied magnetic field. Using bulk samples of high purity sodium, a study of the effect of this anisotropy on the intensity of the resonance signals is presented. Cyclotron resonance with the magnetic field accurately parallel to the surface alters the fields and currents in the skin region. The resulting change in the surface impedance of the metal in turn alters the lineshape of the spin resonance signals. The effect is interpreted in terms of the Azbel'-Kaner theory of cyclotron resonance. Finally, a remeasurement of the temperature dependence of the spin relaxation time in bulk sodium is reported, extending the previous data to lower temperatures. Dissert. Abstr.

N71-38041 State Univ. of New York, Stony Brook.
NUCLEAR ANTIFERROMAGNETIC SUSCEPTIBILITY IN SOLID HELIUM THREE
Wiley Price Kirk (Ph.D. Thesis) 1970 166 p
Avail: Univ. Microfilms Order No. 70-18019

The nuclear magnetic susceptibility in bcc solid He-3 was measured between temperatures of 5.3 mK and 800 mK for molar volumes between 21.0 and 24.0 cc/mole. In each case, the susceptibility followed a Curie-Weiss law with a negative Curie-Weiss constant, hence a negative exchange interaction energy, J. Magnetic behavior of this type is expected for an antiferromagnet. The Neel temperature as computed from each Curie-Weiss constant decreased from 2.0 + or - 0.26 mK to 0.30 + or - 0.21 mK when the molar volume decreased from 24.0 to 21.0 cc/mole respectively. Values of J as a function of molar volume were obtained from the absolute Curie-Weiss constants. These values were compared with values obtained by different experimental methods, and good agreement was found with the values from pressure measurements. The results are also compared with theoretical predictions. Dissert. Abstr.

N71-38042 Pittsburgh Univ., Pa.
NUCLEAR SPIN-LATTICE RELAXATION VIA PARAMAGNETIC CENTERS IN THE ROTATING REFERENCE FRAME
Kyoung Hoon Kim (Ph.D. Thesis) 1969 92 p
Avail: Univ. Microfilms Order No. 70-16370

The Lowe-Tse theory of nuclear relaxation via paramagnetic centers in the rotating reference frame was extended and found to disagree with that of Solomon and Ezratty (1962). The diffusion-limited region in the rotating reference frame was clearly found and agrees with the extended Lowe-Tse theory. In addition, multiple spin-echo measurements in CaF2 single-crystal were carried out. The magnetization was found to decay exponentially with a time constant. The results are in good agreement with those of Mansfield and Ware (1968). Dissert. Abstr.

N71-38043 California Univ., Berkeley.
SPIN LATTICE RELAXATION BY NUCLEAR MAGNETIC RESONANCE ON ORIENTED NUCLEI
John Arthur Barclay (Ph.D. Thesis) 1969 110 p
Avail: Univ. Microfilms Order No. 70-17505

Nuclear magnetic resonance was detected at 0.004 - 0.010 K by perturbation of the gamma ray anisotropy of Co-60 in Fe, Co, and Ni. The existence of a hard-core value at resonance is demonstrated. Frequency modulation of the inhomogeneous line was necessary in order to perturb all of the spin packets in the broadened lines. The optimum conditions for frequency modulation were found by varying the modulation bandwidth and modulation frequency. A simple model was proposed to explain the observed degree of perturbation. In addition, nuclear spin-lattice relaxation times were measured in the 0.004 - 0.010 K temperature range. Interpretation of the data was done by fitting the data to a sum of exponentials. Precise T(1) results are obtained but the accuracy was uncertain due to the uncertainty of the initial conditions. Dissert. Abstr.

N71-38044 Cornell Univ., Ithaca, N.Y.
A STUDY OF LOW ENERGY ELECTRON DIFFRACTION (LEED) INTENSITIES FROM CLEAVED SURFACES OF ZINC AND BERYLLIUM
John Michael Baker (Ph.D. Thesis) 1970 227 p
Avail: Univ. Microfilms Order no. 70-17459

The intensities of electrons diffracted from (0001) surfaces were studied as a function of the direction and energy of the incident beam. The crystals were cooled to liquid nitrogen temperature and cleaved in a vacuum of 10 the minus 10th power torr or less. The incident beam current was measured simultaneously with the diffracted intensity. Intensities were recorded as a function of energy between 10 to 300 eV over a range of angles of incidence. The intensity curves are generally complex. They are sensitive to the direction of incidence, showing that dynamic interactions among the excited beams are important, i.e. strong multiple scattering is taking place. On contamination with Co or O2, neither metal forms a superstructure, and the I-V curves do not change. The intensity of Bragg peaks of zinc were studied as a function of temperature and the results were interpreted in terms of increased vibrational amplitudes for surface atoms. The results are compared with intensity calculations using a wave matching formalism and a simplified crystal model. Dissert. Abstr.

25 PHYSICS, PLASMA

Includes magnetohydrodynamics. For applications see: 28 Propulsion Systems.

N71-38045# Lund Univ. (Sweden). Dept. of Electrical Engineering.
FORCED AND FREE OSCILLATIONS. SOME ASPECTS OF LONGITUDINAL PLASMA WAVES
Anders Ljungstroem (Ph.D. Thesis) May 1970 62 p refs
(NP-18873; TR-70-2) Avail: AEC Depository Libraries

The plasma considered consists of a large number of free electrons and a background of positive ions. The state of the plasma is described by a distribution function, which is assumed to satisfy the Boltzmann equation. The initial-value problem is solved, and it is shown that van Kampen's solution is equivalent to that one deducted from the Vlasov equation. It is shown that van Kampen's stationary solutions may be regarded as forced oscillations caused by a force field that vanishes in an arbitrarily large region. The behavior of the stationary waves is shown to be, in a sense, unstable. A deduction of the solution of the Vlasov equation is presented in connection with a plasma model where it is assumed that every single particle can be followed in the course of its motion, and that a particle initially being in the neighborhood of each electron is characterized by its position (x,v) in phase space when traveling as a free particle. Author (NSA)

N71-38046# Academy of Sciences (USSR), Leningrad. Fiziko-Tekhnicheskii Inst.
STUDY OF ABSORPTION OF SHF WAVES BY PLASMA AT UPPER HYBRID FREQUENCIES
A. I. Anisimov, N. I. Vinogradov, V. E. Golant, and L. P. Pakhomov 1970 13 p refs In RUSSIAN
(NP-18807) Avail: AEC Depository Libraries

The drift velocity and absorption of shf waves by plasma were determined from measurements of spatial distribution of charged particle concentration in a toroidal magnetic field. It was found that the shf absorption by plasma was localized in a relatively narrow region of 1.5 to 2.0 cm. The region of the shf energy absorption coincides with the region of propagation of plasma waves, formed as a result of linear transformation induced externally by electromagnetic waves, and the attenuation length is close to the calculated absorption length of these waves. Author (NSA)

N71-38047# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Sukumi (USSR). Fiziko-Teknicheskii Inst.
EXPERIMENTAL INSTALLATION R-OHM FOR STUDYING HIGH-FREQUENCY FIELD-INTERACTIONS WITH PLASMA
R. A. Demirkhanov, A. G. Kirov, V. B. Malkurov, A. Z. Rakhelkin, I. S. Savchenko et al 1969 86 p refs In RUSSIAN
(NP-18801) Avail: AEC Depository Libraries

Physical concepts introduced into the development and design of the R-Ohm and its construction are described. Calculations of the quasi-constant and high-frequency magnetic fields, the high-frequency system, and parameters of the installations are given in detail. Author (NSA)

N71-38048# Institut fur Plasmaphysik G.m.b.H., Garching (West Germany).
VLASOV DESCRIPTION OF A SUPER-CRITICALMAGNETO-ACOUSTICCOMPRESSION PULSE
R. Chodura and Graf Finck von Finckenstein Dec. 1970 45 p
(IPP-1/113; IPP-6/92) Avail: AEC Depository Libraries

The time evolution of a compression pulse driven by a fast-rising magnetic field and propagating perpendicularly to a homogeneous biased magnetic field is investigated numerically. The compression parameters are chosen such that overturning occurs in the pulse (supercritical pulse). The fluid description of the ions then breaks down and is replaced by a Vlasov description. The ion distribution develops a two-stream structure giving rise to a strong broadening of the spatial density profile of the pulse, the occurrence of an upstream foot in the magnetic-field profile, and strong heating of the ions. Author (NSA)

N71-38049# Academy of Sciences (USSR), Moscow.
HALL EFFECT IN PLASMA OSCILLATIONS
Yu. L. Igitkhanov and B. B. Kadomtsev 1970 36 p refs In RUSSIAN
(IAE-1950) Avail: AEC Depository Libraries

The case of plasma oscillations where the Hall effect is essential is discussed. The arbitrary-amplitude electron oscillations of helical symmetry, neglecting the inertia effect in a conducting medium in a strong magnetic field are described. It is shown that ordinary helicons are the particular case in a broader set of solutions with frequencies independent of the amplitude. The stability of a low-density pinch, and the drift velocity of the electrons above the Alfven phase velocity are considered. In the absence of longitudinal magnetic fields, the pinch proves to be stable, the instability arising as a result of a resonance between the slow helicon and Alfven wave. The finite-amplitude m = 0 mode oscillations in an electron-hole pinch are considered. It is shown that the nonlinearity does not stabilize the sausage modes in intrinsic semiconductors. In extrinsic semiconductors, it appears that a stabilizing effect due to the plasma drift along the electric field exists. Author (NSA)

N71-38050*# California Univ., Los Angeles. Plasma Physics Group.
ELECTROMAGNETIC PLASMA WAVE PROPAGATION ALONG A MAGNETIC FIELD
Craig L. Olson Sep. 1970 41 p refs
(Grants NGR-05-007-190; NSF GP-6817; Contracts N00014-69-A-0200-4023; AT(04-3)-34)
(NASA-CR-121918; R-79) Avail: NTIS CSCL 20I

The linearized response of Vlasov plasma to the steady state excitation of transverse plasma waves along an external magnetic field is examined by an idealized delta function mechanism. The response was found to consist of three terms-branch cut, a free stream, and dielectric pole. These terms are examined analytically, and numerically evaluated for a case in which the driving frequency is slightly below the electron cyclotron frequency. The effects of Krook model collisions are investigated as well as the effects of a finite width excitation mechanism. Steady state transverse plasma wave echoes are also determined using the Vlasov-Maxwell equation. It was shown that a transverse echo results in lowest order only when one excitation is transverse and the other longitudinal. Several extensions, effects of Fokker-Planck collisions and finite width excitation mechanisms, effects of temporary anistropy, and the effects of propagation just-off axis, are examined. Transverse echoes for the case of no external magnetic field are also considered. Author

N71-38051*# Translation Consultants, Ltd., Arlington, Va.
THE SELF-MODELING PROBLEM OF A HIGH-CURRENT DISCHARGE IN A PLASMA [AVTOMODELNAYA ZADACHA O SILNOTOCHNOM RAZRYADE V PLAZME]
P. P. Volosevich et al Washington NASA Sep. 1971 17 p refs Transl. into ENGLISH from Zh. Vychislitelnoi Mat. i Mat. fiz. (Moscow), v. 10, no. 6, 1970 p 1447-1457
(Contract NASw-2038)
(NASA-TT-F-13569) Avail: NTIS CSCL 20I

Self-modeling solutions in which the mass of the plasma in the discharge does not vary with time are examined. It is demonstrated that such solutions exist only in the presence of sufficiently large values of the coefficient of thermal conductivity. The existence of a high-temperature T-layer under certain conditions in the self-modeling regime is established. The analysis of self-modeling solutions is supplemented with numerical calculations of the system of magnetohydrodynamic equations both in the self-modeling and in the near-self-modeling region of parametric variations. Author

N71-38052# Nagoya Univ. (Japan). Inst. of Plasma Physics.
HYDROMAGNETIC MOTION IN THE GEOMAGNETIC TAIL
Jun-ichi Sakai and Teiaichi Kawamura Jan. 1971 9 p refs
(IPPJ-103) Avail: AEC Depository Libraries

By the presence of the bulk plasma flow in the geomagnetic tail, the typical hydromagnetic waves that are periodic in space along the main magnetic field, have some structures across the plasma sheet. Author (NSA)

N71-38053# Princeton Univ., N.J.
NEW TECHNIQUE OF USING MILLIMETRIC AND SUBMILLIMETRIC WAVES
J. Bled et al [1970] 25 p refs Transl. into ENGLISH from the French report
(MATT-Trans-9) Avail: NTIS

The extension of the microwave realm to submillimeter waves and the practical conditions of their utilization make it necessary to modify adequately the techniques and apparatus previously used. The methods and elements based on propagation of the TE sub 01 mode in oversized rectangular guides seem to be well suited to this end. Those developed for the band between 0.5 and 5 mm are described. They are characterized by low transmission losses, great ease of setup and alignment, low cost, and very wide band. Author (NSA)

N71-36054# Technische Hogeschool, Eindhoven (Netherlands).
INVESTIGATION OF THE CONSTRICTED POSITIVE COLUMN IN NEON
Cornelis Adrianus Maria Mouwen (Ph.D. Thesis) Jun. 1971 125 p refs
Avail: NTIS

The constricted positive column in neon was studied. Particular attention was paid to the behavior of the gas temperature distribution as a function of the various plasma parameters. The distributions were obtained from both thermocouple measurements and from gas pressure measurements and spectrum line broadening experiments. The various plasma diagnostic methods utilized are discussed. A new model for the constricted positive column was developed based on the experimental results. Some distribution functions for relevent plasma quantitites have been calculated using the model and are in good agreement with those obtained from experimental investigations. J.G.M.

N71-36055# Princeton Univ., N.J. Plasma Physics Lab.
PRELIMINARY INVESTIGATION OF OHMICALLY-HEATED PLASMAS IN THE MODEL ST TOKAMAK
D. J. Grove, D. L. Dimock, E. Hinnov, J. C. Hosea, L. C. Johnson et al Oct. 1970 21 p refs Presented at Meeting on Div. of Plasma Phys., Washington, D. C., 4 Nov. 1970
(Contract AT(30-1)-1238)
(MATT-813; Conf-701114-2) Avail: NTIS

Some of the results obtained in the first three months of operation of the Princeton Model ST tokamak are described. The body of the report is the paper submitted to the Fourth European Conference on Controlled Fusion and Plasma Physics (Rome (September, 1970)). Additional figures, which were used in the presentation at Rome and in colloquia at Grenoble and Fontenay-aux-Roses, are given in the Appendix along with complementary comments. Author (NSA)

N71-36056# Los Alamos Scientific Lab., N. Mex.
THE LASL CONTROLLED THERMONUCLEAR RESEARCH PROGRAM Status Report, period ending Oct. 1970
Feb. 1971 86 p refs
(Contract W-7405-eng-36)
(LA-4585) Avail: NTIS

Summaries of research conducted during this report period are given for the following topics: (1) theta pinch, (2) z-pinch, (3) plasma gun program, (4) quadrupole, (5) plasma physics, and (6) plasma simulation. NSA

N71-36057# Academy of Sciences (USSR), Moscow. Inst. Fiziki.
PROBE METHOD FOR RECORDING IONS PRODUCED BY LASER RADIATION IN POST LUMINESCENCE DISCHARGE PLASMA
I. Bakov, I. Kantor, and A. Kim 1970 16 p In RUSSIAN *Its* Preprint No. 122
(NP-18765) Avail: AEC Depository Libraries

The mechanism of ion formation produced by laser radiation was studied by a newly developed probe for ion recording. The method permitted recording of probe current variations of the order of 10 to the minus 9th power during 0.000001 sec, which corresponded to a value of the order of 0.001 at an ion background density of approximately 10 to the 10th power/cu cm. The method was used for studying multiphoton ionization of atoms in excited metastable states of post-luminescence discharges. The multiphoton ionization of excited atoms essentially establishes the mechanism of the interaction of laser radiation with post-luminescence discharge plasma. NSA

N71-36058# Uppsala Univ. (Sweden). Inst. of Physics.
STUDIES OF PLASMA DRIFT IN A FXR DISCHARGE
J. M. Berg and S. K. Haendel 1971 11 p refs
(UUIP-659) Avail: AEC Depository Libraries

Plasma drift in a flash X-ray (FXR) discharge was studied by means of symmetrically placed magnetic probes. The results indicate major changes in position of the discharge column in connection with the pinches. Author (NSA)

N71-36059*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EXPERIMENTS ON A PERMANENT-MAGNET, COMPLETELY RADIATION-COOLED MAGNETOPLASMADYNAMIC ARC THRUSTER
Allen R. Bishop Washington Sep. 1971 11 p refs
(NASA-TM-X-2394; E-6431) Avail: NTIS CSCL 20E

Tests of a completely radiation-cooled multikilowatt magnetoplasmadynamic arc are reported. It was constructed by integrating a permanent magnet with an existing radiation-cooled anode-cathode assembly. The resulting thruster was successfully operated to an arc power of 27 kW while an acceptable maximum magnet temperature of 835 K was maintained. The total thruster specific mass was 2/3 kg/kW. The thruster efficiency was somewhat lower (11 as opposed to 14 percent at 1000-sec specific impulse) than the best previously reported performance for a similar thruster with a water-cooled electromagnet. Author

N71-36060# Royal Inst. of Tech., Stockholm (Sweden). Div. of Electron and Plasma Physics.
TRANSSONIC DECELERATION OF THE SOLAR WIND VIA PLANETARY, COMETARY OR INTERSTELLAR GAS
Max Wallis Feb. 1971 29 p refs
(TRITA-EPP-71-01) Avail: NTIS

Transonic behavior of plasma flows with ionization is investigated. On the single-fluid description, spherically symmetric shock-free solutions are produced. The shock-free solutions are valid for 10 greater than N greater than 1, when sonic conditions are attained at a distance about 120/N a.u. For N less than 1, which interstellar wind explanations of the Lyman alpha observations predict, cosmic ray effects could control the transonic flow in a turbulent transition region, the buffer shell. The two-fluid description is appropriate for the solar wind interaction with the Venusian and cometary atmospheres, when the new ions intrinsically form a subsonic species. The absence of a bow shock ahead of Venus can be explained via this subsonic species, whether or not shock-free solutions exist in the single-fluid picture. Author (ESRO)

N71-36061# Environmental Science Services Administration, Boulder, Colo. Aeronomy Lab.
NONLINEAR THEORY OF MACROINSTABILITIES AND ENHANCED TRANSPORT IN PLASMAS
Jerome Weinstock and Robert H. Williams 7 Jul. 1970 31 p refs
(Contract AT(49-8)-2976)
(TID-25713) Avail: NTIS

A method is described for solving the MHD equations for nonlinear plasma waves and turbulence due to macroinstabilities. It is argued that the dominant nonlinear effect for macroinstabilities is the scattering of fluid elements of charge by plasma waves. The consequent wave-fluid interaction causes an enhanced diffusion coefficient in the continuity equation and an identical enhanced viscosity coefficient in the momentum equation. This enhanced plasma transport is analogous to the eddy transport and Reynolds stress of neutral turbulence. A nonlinear dispersion relation is obtained from the linear dispersion relation by simply adding the enhanced diffusion term to the frequency. It is shown that linear macroinstabilities are stabilized by the enhanced diffusion and viscosity terms. As examples, the enhanced diffusion coefficients and density and electric field fluctuations are calculated for resistive instabilities. Author (NSA)

N71-36062# Toronto Univ. (Ontario). Inst. for Aerospace Studies.
AN EXPERIMENTAL INVESTIGATION OF A NONEQUILIB-

RIUM CORNER-EXPANSION FLOW OF IONIZED ARGON
Oser Igra Dec. 1970 131 p refs Sponsored in part by Natl. Res. Council of Canada
(Grant AF-AFOSR-1368-68)
(AD-726532; UTIAS-161; AFOSR-71-0827TR) Avail: NTIS CSCL 20/9

Experiments using a 15-degree corner-expansion flow of ionized argon, induced by a normal shock wave in a 4 in x 7 in hypervelocity shock tube, have yielded values of the recombination rate constant as a function of temperature and the variation of the plasma flow quantities with distance from the corner. The data were obtained by using mainly a Mach-Zehnder interferometer which had a nine inch diameter field of view. The interferometer had a dual frequency laser light source and was driven by either a ruby or neodymium rod. The theoretically predicted values for three-body, electron-ion-electron collisional recombination rate are in good agreement with those measured gasdynamically in a well defined flow. The measured flow quantities substantiate a previous analysis based on the method of characteristics. Author (GRA)

N71-36063# Columbia Univ., New York.
A STUDY OF STRONG TRANSVERSE IONIZING SHOCK WAVES
Pierre Roland Moriette Jul. 1971 183 p refs
(Contracts AF 49(638)-1634; F44620-71-C-0010)
(AD-727046; AFOSR-71-2063TR; Rept-56) Avail: NTIS CSCL 20/9

Transverse ionizing shock wave experiments were performed in the Columbia High Energy Shock Tube. Shock wave speeds up to one per cent of the speed of light were measured, and the variation of shock speed as a function of bias and drive currents, and initial gas density, was analyzed. The magnetic compression ratio across the shock was measured and found to agree reasonably well with transverse ionizing shock theory. Separation between the shock wave current and the drive current was clearly observed, and this length increased with time. The thickness of the shock magnetic structure was measured as a function of shock speed and compared with calculations. A system energy accounting was made. The design and operation of a neutral particle detector is described, and it was used to determine the ion temperature immediately behind the shock wave. Author (GRA)

N71-36064# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
A THEORETICAL AND EXPERIMENTAL INVESTIGATION OF LANGMUIR PROBES IN A HELIUM DISCHARGE
Willard J. Ekman (M.S. Thesis) Mar. 1971 56 p refs
(AD-726986; GEP/PH/71-7) Avail: NTIS CSCL 20/9

The Langmuir probe theories of Self and Shih, Weymouth, and Kiel for collisional plasmas are examined theoretically. A probe theory for a collision dominated plasma with a collision dominated probe sheath is presented. Spherical probe measurements were made in a hot cathode helium discharge at 0.3 and 0.4 Torr. Good agreement on the ion densities between the Self and Shih method and a method suggested by Medicus was obtained. The Medicus method gave better agreement with second derivative techniques on the determination of plasma potential than the Self and Shih method. Author (GRA)

N71-36065# Illinois Univ., Urbana. Coordinated Science Lab.
ON THE SPATIAL STABILIZATION OF THE BEAM-PLASMA INSTABILITY
E. Atlee Jackson Jun. 1971 38 p refs
(Contract DAAB07-67-C-0199)
(AD-726917; R-518) Avail: NTIS CSCL 20/9

It has been observed in many experiments that when a low density energetic beam of electrons is injected into a plasma, oscillations are generated which increase in amplitude as one moves away from the injection point. At larger distances these oscillations saturate and subsequently decay. There are at least three mechanisms which can be responsible for this control of the linear instability. These are, in the order of increasing nonlinearity: If the linearly unstable modes have a broad spectrum of wave numbers, delta K, then the beam may be stochastically heated as it passes into the plasma. If the unstable modes have a narrow spectrum, it is possible that the generation of harmonics might induce stabilization and decay through their interaction back on the unstable modes. It is this mode-mode coupling which is the primary subject of investigation in the present study. If the mode-mode coupling does not stabilize the system then the oscillations may grow to an amplitude which is large enough to trap the beam particles. As this trapping cuts off the beam movement over the waves, the instability is terminated. Author (GRA)

N71-36066 National Lending Library for Science and Technology, Boston Spa (England).
INVESTIGATION OF SHEARING STRENGTH IN PLASMA COATING
O. B. Chalela et al 17 Mar. 1971 8 p refs Transl. into ENGLISH from Poroshkovaya Met., Akad. Nauk Ukr. SSR (Kiev), v. 10, no. 8, Aug. 1970 p 83-86 In RUSSIAN and ENGLISH
(NLL-LTI-746-752-(9022.401); LTI-737-9987) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

An investigation of the evaluation of the shearing strength of tungsten coating (not adhesion to the substrate) is discussed. It was shown that the distance of vaporization has an influence on the shearing strength and that shearing strength is also dependent on the microstructure and residual stresses. Author

N71-36067 National Lending Library for Science and Technology, Boston Spa (England).
STUDY OF INTERACTIONS BETWEEN PARTICLES OF POWDER AND PLASMA FLOW IN A NOZZLE
L. S. Polak et al May 1971 20 p refs Transl. into ENGLISH from Fiz. Khim. Obrabotki Materialov, v. 2, 1969 p 19-29
(NLL-RTS-6142) Avail: Natl. Lending Library, Boston Spa, Engl.: £1.90; 6 NLL photocopy coupons

Reactions between a flow of plasma and particles of tungsten carbide moving in it were studied experimentally and theoretically. A general analysis of the problem is given and experimental and calculated values are given of particle resistance coefficients and coefficients of heat-transfer from the ionized gas to the particles. Author

N71-36068 National Lending Library for Science and Technology, Boston Spa (England).
THE POSSIBILITY OF SUPPRESSING SCREW MODES OF HYDROMAGNETIC INSTABILITY OF A PLASMA COLUMN CARRYING A CURRENT, BY MEANS OF A FEEDBACK SYSTEM
V. V. Arsenin 1 Jun. 1971 7 p refs Transl. into ENGLISH from the Russian report
(NLL-CTO-759-(9091.9F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

Feedback stabilization of screw modes when the current is uniformly distributed over the plasma column cross section is discussed. A numerical analysis of a model of a straight cylinder of perfectly conducting plasma in a uniform magnetic field and surrounded by a perfectly conducting metal casing is presented. Author

N71-36069 Pennsylvania State Univ., University Park.
THE INTERACTION OF AN OBLIQUELY INCIDENT p-POLARIZED PLANE ELECTROMAGNETIC WAVE WITH A HOT PLASMA HALF SPACE AND PLASMA SLAB
Paul Eugene Bolduc (Ph.D. Thesis) 1969 149 p
Avail: Univ. Microfilms Order No. 70-19389

A relativistic kinetic theory description of the interaction of a plane p-polarized electromagnetic wave obliquely incident on a hot plasma half space and plasma slab is developed. The Laplace transform technique together with the radiation condition and the condition of specular reflection of the electrons at the

interface is used to obtain unique linearized solutions for the fields and the particle distribution in a plasma half space. A proof of self-consistency is presented in the treatment of both the slab and the half space problems. The elementary non-equilibrium thermodynamics of the interaction is discussed in the case of the plasma half space. Power reflection and transmission coefficients are obtained for both problems. The equivalent Fourier series representation is presented for the slab case with no limitations placed on beta. A cursory study of the geometrical resonances in the large beta limit is also presented.
Dissert. Abstr.

N71-36070 Rochester Univ., N.Y.
SMALL AMPLITUDE NONLINEAR THEORY OF THE POSITIVE COLUMN SPIRAL INSTABILITY
Jeng-Nan Shiau (Ph.D. Thesis) 1970 108 p
Avail: Univ. Microfilms Order No. 70-17909

An analysis of the nonlinear behavior of the spiral instability of the positive column in a longitudinal magnetic field is presented. The finite amplitude and frequency shift of the single mode which results from raising the magnetic field slightly above the critical value are determined. The slope at the kink of the E - H curve also is obtained. The method is based on a general theory of nonlinear behavior in weakly ionized plasma. The nonlinear results depend on the ion species present in the discharge and agree favorably with experiments. Dissert Abstr.

N71-36071 California Univ., Los Angeles.
INTERACTION OF QUASI-TRANSVERSE AND QUASI-LONGITUDINAL WAVES IN AN INHOMGENEOUS VLASOV PLASMA
Clyde Lewis Hedrick, Jr. (Ph.D. Thesis) 1970 186 p
Avail: Univ. Microfilms Order No. 70-19853

The wave interaction is considered for frequencies between the electron cyclotron frequency and the maximum value of the upper hybrid frequency. Using a formalism which parallels that used for a homogeneous plasma, the Vlasov equation and Maxwell's equations for propagation perpendicular to the dc magnetic field are solved and a set of coupled differential equations for the components of the electric field are obtained. Fourth order wave equations for the longitudinal and transverse components of the electric field are solved for a linear density profile and connection formulas are derived. Comparison of the solutions for the components provides insight into the coupling which occurs near points where the frequency equals the local upper hybrid frequency. Outside these coupling regions the fourth order wave equation decouples into second order systems for the quasi-longitudinal and quasi-transverse waves. Using an idealized density profile for a bounded plasma, analytic expressions for the transmission and reflection coefficients are obtained. Dissert. Abstr.

N71-36072 Texas Univ., Austin.
COMPUTER SIMULATION OF PLASMA INJECTION AND TRAPPING IN A LINEAR OCTUPOLE
George Lafayette Cardwell, III (Ph.D. Thesis) 1970 147 p refs
Avail: Univ. Microfilms Order No. 70-18213

A model which simulates the plasma is constructed and the restrictions placed on it discussed in detail. The motion of the particles is determined by Newton's equation of motion and the Lorentz force law. The difficulties involved in computing the Coulomb interaction of the particles are discussed. An alternative procedure for computing the electrostatic particle interactions by solving Poisson's equation is presented. A technique for machine solution of Poisson's equation is described in detail. The computer techniques are applied to the study of the injection and trapping of a plasma in a linear octupole. The results of this analysis are presented and compared with the experimental results previously published. Dissert. Abstr.

N71-36073 Ohio State Univ., Columbus.
THE "CHANGE OF FLOATING POTENTIAL" RESONANCE PROBE IN THE FLIGHT DYNAMIC LABORATORY ARC FLOWING PLASMA
James Lee Bunyan (Ph.D. Thesis) 1970 86 p
Avail: Univ. Microfilms Order No. 70-19302

The ability of a modified resonance probe to measure densities by locating the plasma parallel resonance minimum was tested in an arc flowing plasma. The modified probe operated at its floating potential and was turned on and off by a one kilohertz/s square wave. The change of floating potential was measured as a function of the applied frequency. Density measurements conducted simultaneously by the change of floating potential resonance probe and a floating double guardring probe were compared. After conservative compensation for radial density variations the agreement was fairly good. Using the floating double planar guardring probe it was found that the radial variation of densities of the arc flowing plasma near the center of the plane of measurement is not gaussian at low flow rates. This same probe revealed that for various combinations of probe positions and plasma conditions the electron temperatures range from 300 K to 21,000 K.
Dissert. Abstr.

N71-36074 Texas Univ., Austin.
ION-ION HYBRID RESONANCE
Ram Babu (Ph.D. Thesis) 1970 205 p
Avail: Univ. Microfilms Order No. 70-18198

The cold collisionless plasma is investigated for both perpendicular and slightly off the perpendicular directions. The effects of different ion concentrations of two ions of different charge to mass ratio are studied. The effect of the off-perpendicular propagation is to shift the hybrid resonances to the ion cyclotron values of smaller magnitude. In a partially ionized plasma, the collision effects are predominant. The absorption at the resonance is evaluated by calculating the plasma loading resistance, and it is apparent that at hybrid resonances the resistance goes to a minimum. For low pressure the pressure effects do not alter the cold collisionless plasma model. The effects of collisions in the presence of pressure are included. The power transfer calculations are carried out for the collisionless heating effects. For a bounded plasma with azimuthal perturbations in the presence of temperature, the boundary conditions select a set of eigenvalues for the propagation vector and various resonances result. This result is investigated for a two ion plasma. The resonances occur on either side of the lighter ion cyclotron field value. Dissert. Abstr.

N71-36075 California State Coll., Los Angeles.
STEEPENING OF ION ACOUSTIC WAVES AND FORMATION OF COLLISIONLESS ELECTROSTATIC SHOCKS
Robert John Taylor (Ph.D. Thesis) 1970 94 p
Avail: Univ. Microfilms Order No. 70-19904

Large amplitude ion acoustic waves were studied experimentally in a nonmagnetized plasma with electron-to-ion temperature ratios in the range from 5 to 15. The waves were excited in a target plasma by low velocity ions injected from a driver plasma through a negatively biased fine mesh grid interface which blocked the flow of the electrons in both directions. Electrons in the target plasma neutralized the incoming ions. Due to the electron pressure, the neutralization was not quite complete and the ion flow gave rise to an ion acoustic wave which, for small amplitudes, propagated approximately at the ion sound velocity. When a sinusoidal or a ramp excitation was used, classical overtaking (steepening) was observed as given by the usual Riemann invariants. A comparison between experimental and theoretical wave profiles is made. Dissert. Abstr.

N71-36076 Rochester Univ., N.Y.
THE SECOND ORDER SHIFTS IN FREQUENCY AND AMPLITUDE IN THE NONLINEAR THEORY OF E X B INSTABILITY
John Jungyu Kim (Ph.D. Thesis) 1970 89 p
Avail: Univ. Microfilms Order No. 70-17686

Using a single mode analysis, a consistent method to

calculate the shifts in amplitude and frequency to order delta square in the E X B instability is presented, taking into account all nonlinear effects. Galerkins method is applied to obtain approximate results. Dissert. Abstr.

N71-38077 Ohio State Univ., Columbus.
PRODUCTION AND DIAGNOSTIC MEASUREMENTS OF A PULSED HIGH DENSITY KILOVOLT PLASMA EMPLOYING A NONCYLINDRICAL Z PINCH
Carl Boyd Hilland (Ph.D. Thesis) 1970 58 p
Avail: Univ. Microfilms Order No. 70-19319

Plasma focus experiments were conducted using a discharge chamber of the Filippov geometry. Initial plasma heating is performed by the incident shock wave, followed by preferential heating of deuterium ions behind the axis-reflected shock wave. This reflected shock wave is retarded by electrodynamic forces acting radially inward and a second contraction phase occurs in which heating of both electrons and ions proceeds adiabatically. During the final compression, contraction of the plasma to a radius of approximately 1 mm with an implosion velocity on the order of 20 cm/microsecond was observed by streak photography. Ion temperatures of 2.4 KeV, electron temperatures of 1 KeV, and particle densities in excess of 10 to the 19th power/cu cm were attained at the time of the pinch. Neutron yields of 3 x 10 to the 9th power resulted from thermonuclear reactions among deuterium ions and a copious supply of X-rays was observed to be emitted from the anode and anode vapors. Dissert. Abstr.

N71-38640# Joint Publications Research Service, Washington, D.C.
TESTING OF OPEN CYCLE MHD GENERATOR CHANNEL ELEMENTS IN TEMP PLANT
V. V. Kirillov et al *In its* Mater. for MHD Generator Channel 31 Aug. 1971 p 166-176 (See N71-35621 22-18)
Avail: NTIS

26 PHYSICS, SOLID-STATE

Includes semiconductor theory; and superconductivity. For applications see: 16 Masers. For related information see also: 10 Electronics.

N71-38078*# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Electrical Engineering.
STUDY OF SEMICONDUCTOR HETEROJUNCTIONS OF ZnSe, GaAs AND Ge Technical Report, 1 Feb. - 30 Apr. 1971
A. G. Milnes and D. L. Feucht 1971 41 p refs
(Grant NGR-39-087-002)
(NASA-CR-121718) Avail: NTIS CSCL 20L

Single crystal layers of ZnS and ZnSe have been epitaxially grown on p-type GaP using an HCL close-spaced vapor transport system. Grown layer doping is accomplished using heavily doped source (ZnS, ZnSe) material and a zinc vapor diffusion process that reduces the number of compensating zinc vacancies. Experimental characteristics of nZnS-pGaP and nZnSe-pGaP diodes indicate dominance of the forward I-U relationship by space-charge-limited flow in the 1000-10,000 ohm-cm ZnS and ZnSe. The reverse I-U characteristics of these devices agree qualitatively with a multistep tunneling process but show larger than expected reverse currents. The reverse bias capacitance is strongly frequency dependent in all devices studied. Forward injection electroluminescence was not observed from any of the nZnS-pGaP and nZnSe-pGaP devices studied. Further studies were conducted in the iodine system to grow a thin pGe layer followed by an n-type Ge layer on nGaAs to produce a Ge-GaAs transistor. A method using diborane as a dopant was developed to grow the p-type Ge without a thin intermediate n-type Ge layer at the interface. Author

N71-38079*# Martin Marietta Corp., Baltimore, Md. Research Inst. for Advanced Studies.
MAGNETIC SUSCEPTIBILITY OF VANADIUM CARBIDE Quarterly Progress Report
D. W. Bloom (Colo. Univ., Boulder), L. Finegold (Colo. Univ., Boulder), A. Tveten (Colo. State Univ., Ft. Collins), and R. G. Lye May 1971 18 p refs Submitted for publication
(Contract NASw-1290)
(NASA-CR-122039; QPR-23; RIAS-TR-71-11c) Avail: NTIS CSCL 20B

The magnetic susceptibility of single-crystal VC(x) (x = 0.78, 0.81, 0.84, 0.87) was found to decrease sharply as x increases from 0.76, in qualitative agreement with the results of previous measurements made by Bittner and Goretzki on powder specimens. The present results, however, show a minimum near x = 0.84 followed by a slight increase at x = 0.87, and in this respect are similar to the observations of Borukhovich and others in their studies of the other group 5 carbides NbC(x) and TaC(x). This variation of the susceptibility is attributed primarily to the (Van Vleck) orbital paramagnetism, supporting the suggestion made previously by Froideveaux and Rossier. A simple model for the orbital paramagnetism in VC(x) is shown to account qualitatively for the observed variation with carbon content. Author

N71-38080# Helsinki Univ. (Finland). Research Inst. for Theoretical Physics.
ON THE FLUCTUATION ENHANCED CONDUCTIVITY OF A SUPERCONDUCTOR: THE CORRECT EVALUATION OF THE MAKI GRAPH
Albert Schmid Jan. 1971 27 p refs Prepared in cooperation with Karlsruhe Univ.
(NP-18819) Avail: AEC Depository Libraries

According to Maki, the Maki graph gives a contribution to the fluctuation-enhanced conductivity of a superconductor that is infinite in the case of a thin film. It is shown that this result is spurious and that it is due to a breakdown of the standard Green function impurity technique. A new method is developed that is based strictly on the Boltzmann equation. It is shown that the temperature-dependent contribution of the Maki graph to the conductivity is negligibly small in a dirty metal. Author (NSA)

N71-38081# Paris Univ. (France). Laboratoire de Genie Electrique.
PENETRATION OF THE MAGNETIC INDUCTION, ELECTRIC FIELD, AND LOSSES IN IMPURE SUPERCONDUCTORS OF THE SECOND KIND WITH SURFACE CURRENTS [PENETRATION DE L'INDUCTION, CHAMP ELECTRIQUE ET PERTES DANS LES SUPRACONDUCTEURS DE SECONDE ESPECE IMPURS PRESANTANT UN COURANT DE SURFACE]
G. Fournet and A. Maitfert 1970 26 p refs In FRENCH
(Conf-700341-9) Avail: AEC Depository Libraries

The penetration of magnetic induction into very impure Type-2 superconductors traversed by a low-frequency alternating electric current or subjected to a low-frequency alternating magnetic field, is studied. Experiments permitted the critical surface and volume currents for various samples to be determined. A theoretical expression for the electric field, in the material, at any point during the sinusoidal cycle, was deduced. The predicted curves are in good agreement with those experimentally obtained. The analytic expressions for the electric field enabled the losses to be calculated. Formulas obtained for the losses associated with the type of penetration observed in practice (Kim law) are presented. It is shown that surface currents present themselves in the loss expression in a complicated manner and that part of the loss is localized in the surface of the sample. The expression enables the losses occurring at the surface of the sample to be separated from those occuring in the volume. Author (NSA)

N71-38082# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy). Servizio Documentazione.
TECHNICAL-ECONOMIC INFORMATION ON SUPERCON-

DUCTORS AND CONDUCTORS FOR HIGH FIELD MAGNETS [INFORMAZIONI TECHNICO-ECONOMICHE SUI SUPERCONDUTTORI E SUI CONDUTTORI PER MAGNETI AD ALTO CAMPO]
G. Pasotti and G. Secerdoti 15 May 1970 6 p refs In ITALIAN *Its* Nota Interna No. 475
(LNF-70/19; LNF-70/5-App) Avail: AEC Depository Libraries

Technical-economic data are presented for four cases: copper conductors operating at room temperature, copper conductors operating at 20 K, aluminum conductors operating at 20 K, and superconductors operating at 4.2 K. Cost factors for different current densities and fields are tabulated. NSA

N71-38083# Montpellier Univ. (France). Faculte des Sciences.
PHONON SCATTERING IN GALLIUM ANTIMONIDE. THE EFFECT OF ZINC AND TELLURIUM DOPING AND ELECTRON IRRADIATION [DIFFUSION DES PHONONS DANS L'ANTIMONIURE DE GALLIUM. EFFETS DES DOPAGES EN TELLURE ET EN ZINC ET DE L'RADIATION ELECTRONIQUE]
Anne-Marie Cazal-Poujade (Ph.D. Thesis) 1970 200 p refs In FRENCH
(NP-18836; CNRS-AO-4867) Avail: AEC Depository Libraries

The effect on the thermal conductivity at low temperature of doping antimony and gallium with tellurium and zinc and electron irradiation was studied. The effect of progressive compensation by tellurium doping on phonon scattering was established, the material remaining p-type. A systematic study at 300 K was made of n-type materials. The variation in the additional thermal resistivity with carrier concentration was evaluated. The effect of Zn doping on the electrical properties and the thermal conductivity was examined permitting the effects of impurities on the different types of carrier conduction to be determined (isolated impurities, band impurities, and overlapping bands). The effect of the irradiation at 40 C of n- and p-type GaSb with 4-MeV electrons was studied. The n- to p-type transition caused by the radiation was studied and the importance of the levels introduced and their charge states on phonon scattering was estimated. Irradiated nondoped p-type GaSb was studied in order to establish the effect on K of the levels and defects introduced. Author (NSA)

N71-38084*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SOLUTION OF THE POTENTIAL IN A SEMICONDUCTOR WITH EXPONENTIALLY DEPTH-DEPENDENT CONDUCTIVITY AND APPLICATION TO FOUR-POINT-PROBE MEASUREMENTS
R. K. Franks (Appalachian State Univ.) and J. B. Robertson Washington Sep. 1971 16 p refs
(NASA-TN-D-6504; L-7875) Avail: NTIS CSCL 20L

An exact solution has been obtained for the potential due to a point current source on a semiconductor whose conductivity varies exponentially with depth. The solution was obtained by solving the continuity equation in cylindrical coordinates and applying the appropriate boundary conditions. This solution was then applied to the interpretation of the four-point-probe method of measuring semiconductor conductivity. Author

N71-38085# Aerospace Corp., El Segundo, Calif. Electronics Research Lab.
JOSEPHSON WEAK LINK DEVICES Final Report, Jul. 1969 - Sep. 1970
Arnold H. Silver and James E. Zimmerman (NBS, Washington, D. C.) 30 Nov. 1971 200 p refs
(Contract F04701-70-C-0059)
(AD-726537; TR-0059(6230-01)-1; SAMSO-TR-71-18) Avail: NTIS CSCL 20/12

Superconducting weak links in various forms have the common feature that the supercurrent through the link is a periodic function of the gauge invariant quantum mechanical phase difference across the link (the Josephson effect). A convenient form of this relation is i sub s = i sub c sine theta. The main qualitative features of devices derived from such weak links are derived according to analytically convenient relations. The variation of the supercurrent with time is determined by the second Josephson relation. For most practical superconducting device applications, the chemical potential difference is simply 2 eV, where e is the electronic charge and V is the time-dependent voltage across the weak link. The total current through a weak link consists of three terms, the supercurrent i sub s = i sub c sine theta, a normal current i sub n = GV characterized by a conductance G and a displacement currrent i sub d = CV characterized by the shunt capacitance C of the weak link. The interaction of these three terms with each other and with any external circuit elements leads to a rich variety of experimentally observable and useful phenomena. Various forms of these effects are described and explained. This phenomenon provides the basis of a fundamental voltage standard, and heterodyne and video detectors of high frequency radiation. GRA

N71-38086# Lincoln Lab., Mass. Inst. of Tech., Lexington.
ADVANCED ELECTRONIC TECHNOLOGY Quarterly Technical Summary, 1 Feb. - 30 Apr. 1971
Melvin Herlin and Alan L. McWhorter 15 May 1971 23 p
(Contract F19628-70-C-0230)
(AD-726535; ESD-TR-71-140) Avail: NTIS CSCL 09/2

Contents: Integrated circuit development; Photolithographic interconnection of plastic-imbedded semiconductor chips; Semiconductor testing; Machine development; Solid state device research; Materials research; Physics of solids; Microelectronics. GRA

N71-38087# Yale Univ., New Haven, Conn. Dept. of Engineering and Applied Science.
ELECTRONIC RAMAN SCATTERING THEORY IN RARE EARTH GARNETS
Joan L. Lewis (Ph.D. Thesis) Jul. 1971 175 p refs
(Contract F44620-69-C-0102)
(AD-727065; AFOSR-71-1804TR; TR-1) Avail: NTIS CSCL 20/12

The work involves the calculation of the relative Raman scattering intensities of low-lying electronic transitions in rare earth garnets. An evaluation is made as to the usefulness of such calculations in testing the crystal field wavefunctions of rare earth garnets. The garnets studied are paramagnetic YbGaG, YbAlG, DyGaG, and DyAlG. DYALG is also studied at temperatures below its ordering temperature (T sub N-2.5 degrees K) and with an applied magnetic field. In order to obtain crystal field wavefunctions necessary for the relative Raman intensity calculations, crystal field analyses are done in this work for DyGaG and DyAlG. For YbGaG and YbAlG the wavefunctions of Pearson (1971) are used in the intensity calculations. Simple expressions of the relative scattering intensities are derived for the paramagnetic and the antiferromagnetic cases. Such expressions are obtained for several different combinations of the polarizations of the incident and scattered light. Author (GRA)

N71-38088# New York Univ., N.Y. Dept. of Chemical Engineering.
RESEARCH DIRECTED TOWARD PREPARATION OF COMPOUND SEMICONDUCTORS BY CONTROLLED DIFFUSION MECHANISM IN GELS Final Report, 10 Jan. 1967 - 30 May 1969
Zwi Blank and Walter Brenner Mar. 1970 214 p refs
(Contract F19628-67-C-0194)
(AD-727035; AFCRL-70-0252) Avail: NTIS CSCL 20/2

Single crystal growth in gels near ambient temperature offers many advantages, especially for substances which are slightly soluble in water and which are not easily grown from the melt or vapor. Selected group 2-6 compounds have been studied in this respect because of their potential for semiconductor applications. The role of major variables affecting nucleation and growth (including diffusion rates of reactants) was clarified. A graphical solution of the equation for diffusion rates has been developed, permitting the gel growth optimization of single

crystals, particularly lead sulfide. Experimental data obtained for single crystals of lead sulfide and selected other group 2-6 compounds are summarized emphasizing electronic properties. A novel system for batch and continuous gel growth of lead sulfide crystals up to 2mm on edge near ambient temperature is described. Additional studies are suggested to broaden the applicability of crystal growth in gels. Author (GRA)

N71-36089# Clevite Corp., Cleveland, Ohio. Electronic Research Div.
RESEARCH ON IMPROVED II - VI CRYSTALS Final Technical Report, 1 Jun. 1970 - 31 Jan. 1971
L. R. Shiozawa and J. M. Jost Wright-Patterson AFB, Ohio ARL Mar. 1971 38 p refs
(Contract F33615-68-C-1601)
(AD-727048; ARL-71-0054) Avail: NTIS CSCL 20/2

Vapor phase growth of single-crystal boules of CdTe, CdSe, ZnTe, and CdS was attempted by the seed-growth method using a capillary leak to maintain a stoichiometrically-proportioned vapor composition during the growth process. Although a measure of success was attained, difficulties arose such as formation of extraneous nucleation and occurrence of inclusions of SiO2 particles. Single-crystal growth at relatively high growth rates over at least a limited seed area was obtained for each compound for the complete length of the boule. Improved techniques should eliminate much of the difficulty but some modifications of the method may be necessary to attain complete success. An analysis of multiple twinning in CdTe and ZnTe crystals occurring during the growth process is also given. Author (GRA)

N71-36090# Ohio State Univ. Research Foundation, Columbus.
EPITAXIAL DEPOSITION OF SILVER ON MOLYBDENITE
G. Pilkington and J. P. Hirth Jun. 1971 30 p refs
(Contract N00014-67-A-0232-0006)
(AD-726749; OSURF-2966-TR-3) Avail: NTIS CSCL 20/2

Silver was found to deposit epitaxially on molybdenite at substrate temperatures from -165C to 625C. The degree of epitaxy decreased with decreasing substate temperature with rotations of up to 4 degrees. An hcp silver phase was observed at low substrate temperatures. The results are discussed in terms of the theory of heterogeneous nucleation. Author (GRA)

N71-36091 National Lending Library for Science and Technology, Boston Spa (England).
DISORIENTATION OF SUBSTRUCTURE OF METALS WITH FACE-CENTERED CUBIC LATTICE DURING HIGH-TEMPERATURE DEFORMATION
P. N. Okrainets et al 17 Mar. 1971 12 p refs Transl. into ENGLISH from Fiz. Metallov. Metalloved. (USSR), v. 29, no. 6, Jun. 1970 p 1204-1209 In ENGLISH and RUSSIAN
(NLL-LTI-746-728-(9022.401); LTI-737-9720) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The change of disorientation angles in the substructure of large-grain polycrystalline nickel and copper samples was studied under conditions of slow loading at 0.45, 0.56, and 0.68 of the melting temperatures. The dependencies of the substructural disorientation angle on the amount of deformation, loading, and temperature were established. It was shown that the difference in the dependencies obtained for nickel and copper are specified by the difference in stacking fault energy of the metals. Author

N71-36092 Pennsylvania State Univ., University Park.
ELECTRICAL TRANSPORT PROPERTIES OF THIN BISMUTH FILMS
Richard Allen Hoffman (Ph.D. Thesis) 1969 155 p
Avail: Univ. Microfilms Order No. 70-19420

Bismuth films of high purity having a well-ordered crystal structure were grown. The resistivity and Hall coefficient of films with thicknesses of 700 - 37,000 A were measured between 1.16 and 300 K, and the magnetoresistance coefficient was measured at 1.15, 4.2, 77, and 300 K. Surface scattering in these films is not specular. An additional size-dependent, temperature-dependent scattering mechanism existing in thin film transport is indicated. The Hall and magnetoresistance coefficients vary consistently with sample thickness. The transport properties of bismuth films are drastically affected by imperfections such as impurities, crystal misorientation, and vacancies. Quantum size effect oscillations were observed in all the transport properties at low temperatures. Dissert. Abstr.

N71-36093 Utah Univ., Salt Lake City.
A STUDY OF PARAELECTRIC DEFECTS IN ALKALI HALIDE CRYSTALS WITH OPTICAL AND CALORIC METHODS
Siegmar Erwin Kapphan (Ph.D. Thesis) 1970 153 p
Avail: Univ. Microfilms Order No. 70-19524

The electric field induced alignment and the reorientation kinetics of substitutional paraelectric impurities in various alkali halide crystals were studied, using electrocaloric and electro-optical methods. Both techniques yield results, which depend on the direction of the applied electric field, reflecting the fact that the paraelectric dipoles are restricted by the crystalline field to specific symmetry directions of the lattice. Using the results from these static measurements, both optical and caloric techniques were used in connection with time dependent electric fields to study the relaxation behavior of the paraelectric systems. The dipole lattice relaxation time was found to depend strongly on the host lattice, varying over 12 orders of magnitude. Dissert. Abstr.

N71-36094 Washington Univ., Seattle.
SPIN RELAXATION STUDIES IN STABLE ORGANIC FREE RADICALS
Edward Jay Hill (Ph.D. Thesis) 1970 107 p
Avail: Univ. Microfilms Order No. 70-18928

The stable organic free radicals studied are 2,2-diphenyl 1-picryl hydrazyl (DPPH), 1,3-bis-diphenylene 2-phenyl allyl (BDPA), 2,6-di-tert.-butyl 4(3,5-di-tert.-butyl 4-oxocyclohexa 2,5-dienylidene methyl) phenoxyl (galvinoxyl), and 1,3,5,-triphenyl verdazyl (TPV). The EPR experiments were performed at 9.2 GHz from 300 K to 1.6 K on single crystals in a helium atmosphere. The BDPA and TPV have RF susceptibility maxima at 5 K and 6 K, respectively, while DPPH and galvinoxyl show no maxima. At high temperature the RF susceptibilities are described by the Curie-Weiss law. The line widths of the EPR signals of each radical were temperature independent from 300 K to about 60 K; below 60 K there was a monotonic line width increase. Spin-phonon coupling was studied using coherent microwave phonons generated by the piezoelectric effect in quartz. Sound waves which had passed coherently through the sample were detected. Acoustic paramagnetic resonance studies indicated that the direct spin-lattice coupling is weak. Samples of thin DPPH and BDPA were produced by vapor deposition. These samples maintained their unpaired electron on 50% to 72% of the molecules, and the magnetic resonance properties were unchanged as measured by EPR experiments. Dissert. Abstr.

N71-36095 Washington Univ., Seattle.
STUDIES OF ELECTRICAL CONDUCTIVITY IN ORGANIC FREE RADICALS
David Edward Hemerski (Ph.D. Thesis) 1970 129 p
Avail: Univ. Microfilms Order No. 70-18925

Electrical conduction phenomena were investigated in the temperature range 345 to 0.3 K in crystals of stable 1,3-bis-diphenylene 2-phenyl allyl and 1,3,5-triphenyl verdazyl and, while extending the voltage range, in 2,2-diphenyl 1-picryl hydrazyl. The current-voltage characteristics taken along crystal axes were characterized by a linear region up to approximately 1000 volts/cm. Lower limits for the values of the drift mobilities were calculated as a function of temperature in the range 345 to 180 K. Dielectric relaxation and pyroelectric effects were readily observed. Measurements of the conductivity in the dark were made on polycrystalline compactions in the 345 to 18 K range, and were consistent with those showing that the dc conductance

in an ideal random powder is almost completely determined by the lowest conductivity component. No differences were observed when the crystals were placed in a zero magnetic field environment. The limiting mobility as a function of temperature was used to calculate the electron-phonon interaction parameter gamma, which was in the range 10 to 15. The extension of the molecular crystal model of small polaron transport as the mechanism of charge transport for T less than 180 K is discussed. Dissert. Abstr.

N71-36096 Louisiana State Univ., Baton Rouge.
TRANSPORT PROPERTIES OF THALLIUM AND THE EFFECTS OF SMALL ANGLE SCATTERING IN METALS
Robert Eugene Hamburg (Ph.D. Thesis) 1970 129 p
Avail: Univ. Microfilms Order No. 70-18533

A set of measurements were made at 4.1, 3.0, 2.0, and 1.8 K in magnetic fields ranging from 12.2 kG to 18.4 kG. Evidence was found supporting the hypothesis that open orbit electrons in thallium may be efficiently scattered into closed orbits by the mechanism of small-angle phonon scattering. Formulas were derived which allowed the calculation of the average number of electron-phonon collisions necessary to remove an electron from an open orbit. Quantitative agreement was obtained between the experimental calculations and the expected theoretical predictions. Reasons for the lack of good quantitative agreement are discussed both from the point of view of experimental errors and in view of the over-simplifying assumptions and approximations of a problem of scattering which is basically complex. The results indicate that the effect studied here, the efficient small angle phonon scattering of open orbit electrons, may be observable in other metals and is a useful method of studying the transport properties of metals. Dissert. Abstr.

N71-36097 Rensselaer Polytechnic Inst., Troy, N.Y.
THE ELASTIC CONSTANTS OF DENTAL AMALGAM AND ITS COMPONENT ALLOYS
J. Lawrence Katz (Ph.D. Thesis) 1969 234 p
Avail: Univ. Microfilms Order No. 70-19957

The pressure dependence of the elastic constants of dental amalgam and its constituent alloys were investigated in the 0 to 50 kilobar range using a solid media, high pressure apparatus. An ultrasonic interferometer was used to measure the longitudinal and transverse ultrasonic wave velocities in these materials. The bulk, shear, and Young's moduli and Poisson's ratio were calculated directly as functions of pressure from the velocities. Anomalous behavior in the elastic constants of the alloys gamma-Ag3Sn and gamma sub 2 - Hg - Sn suggests the possibility of phase transitions or electronic rearrangements in the alloys at high pressures. Gamma sub 1 - Ag2Hg3 showed normal behavior. The results of the measurements were used to develop a model of dental amalgam which relates its elastic properties to its structure and composition. Dissert. Abstr.

N71-36098 Rensselaer Polytechnic Inst., Troy, N.Y.
TRANSPORT PARAMETERS FOR POINT DEFECT SCATTERING IN NFEM METALS
Michael Dennis Feit (Ph.D. Thesis) 1970 114 p
Avail: Univ. Microfilms Order No. 70-19936

A general method for calculating the electron mean free path of small band gap metals in a nearly free electron model in which only a pair of Brillouin zone planes is considered at a time was developed. Functions that are largely concentrated at the zone boundary (such as the Bloch wave expansion coefficients) and functions that are distributed over the Fermi surface are distinguished. The procedure, related to the variational method, is to postulate a parametrized trail solution that explicitly contains the concentrated functions. It is then possible to find a formal solution to the desired order in the band gap energy to Fermi energy ratio in terms of certain integrals of the scattering form factor. With a given form factor a modest amount of computation serves to determine the free path. Dissert. Abstr.

N71-36099 Purdue Univ., Lafayette, Ind.
THERMAL RESISTIVITY OF CADMIUM, MAGNESIUM AND ALLOYS AT LOW TEMPERATURES
Ronald Henry Bogaard (Ph.D. Thesis) 1970 58 p
Avail: Univ. Microfilms Order No. 70-18600

The intrinsic thermal resistivity (W sub i) of pure Cd and CdZn single crystals with residual resistance ratios in the range 50,000 to 500 (Zn content up to .6 at %) were measured for both hexagonal and basal orientations in the temperature range 3 K < T < 100 K. The Cd data were represented by W sub i varies directly with T to the nth power. In the case of pure Cd n = 2 for T < 3.5 K, whereas for the most impure alloy n = 2 for T < 13 K. For temperatures above the n = 2 region n was found to be as large as 4.5 in the interval 4 K < T < 7 K in the case of the purest crystal. The known, rapid change of the specific heat Debye theta does not explain the large n. This would imply a diminished interaction between the electrons and transverse phonons. A comparison between the electrical and thermal resistivities indicates that the electrical and thermal scattering processes are more similar than generally has been assumed. In addition, several samples of Mg were measured comprising pure polycrystals and single crystals with residual resistance ratios ranging from 1700 to 210 as well as two alloys (MgZn and MgPb), each having .1 at % impurity. Dissert. Abstr.

N71-36100 Princeton Univ., N.J.
A STUDY OF ZINC OXIDE POWDER USING DIELECTRIC RELAXATION
Robert C. Blosser (Ph.D. Thesis) 1970 173 p
Avail: Univ. Microfilms Order No. 70-19769

A study of the dielectric relaxation of interfacial polarization in ZnO powder is used to determine the properties of the powder as well as the properties of the intergrain region between the powder particles. The technique involves the measurement of the ac impedance of the powder contained in a capacitance cell. Two types of samples were tested: loose ZnO powder and ZnO powder suspended in a plastic resin. The technique was found to yield the resistance and capacitance of both the powder particles and the intergrain barriers as well as a spread parameter representative of the nonuniformity of the powder properties. The powder properties obeyed a model provided only weak pressure was applied to the powder. The ZnO suspended in binder at room temperature had properties similar to the loose ZnO powder in air (as opposed to vacuum). Both samples, ZnO in binder and loose ZnO, had similar grain conductivity activation energies of about .6 eV; however the intergrain regions were characterized by different activation energies. Dissert. Abstr.

N71-36101 Rochester Univ., N.Y.
POLARIZATION DEPENDENCE OF TWO-PHOTON ABSORPTION IN SOLIDS
Todd Richard Bader (Ph.D. Thesis) 1970 177 p
Avail: Univ. Microfilms Order No. 70-17862

Dependence was studied experimentally and theoretically as a means of identifying electron state symmetries. Polarization dependence was independent of one-electron state symmetries and the orientation of photon polarizations with respect to the crystal axes. Mathematical expressions and tables are obtained for allowed Gamma-point transitions between states of arbitrary symmetry for the thirty-two point groups and for transitions at other symmetry points in hexagonal close-packed and wurtzite structures. For forbidden transitions a simpler band model is used neglecting exciton effects. Polarization dependence is calculated for forbidden X-point transitions in the two-band model. The two-photon absorption is dependent on the symmetries of the initial and final states and on the orientation of the polarization vectors with respect to the crystal axes. Dissert. Abstr.

N71-36102 California Univ., Berkeley.
MASS ENHANCEMENT AND SUPERCONDUCTING TRANSITION TEMPERATURE CALCULATIONS FOR

METALS AND SEMICONDUCTORS
Philip Brown Allen (Ph.D. Thesis) 1970 137 p
Avail: Univ. Microfilms Order No. 70-17493

The theory of the electron-phonon interaction and the renormalization of electronic properties in degenerate systems is developed and applied to three problems. The first problem is the superconducting transition temperature of the degenerate semiconductors SnTe and GeTe. Intravalley electron-electron interactions, especially the coupling via polar phonon modes, is considered.The second problem is the mass enhancement and superconducting transition temperature of the nontransition metals. A simple calculation is presented of the electron-phonon coupling parameter, using pseudopotential matrix elements of the electron-phonon interaction within a single orthogonalized plane wave approximation. The third problem is the temperature dependence of the electron-phonon mass enhancement. Calculations of the temperature shift of the mass enhancement are presented for sixteen nontransition metals. Dissert. Abstr.

27 PROPELLANTS

Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems.

N71-36103*# GCA Technology Div., GCA Corp., Bedford, Mass.
HAZARD ESTIMATES FOR SELECTED ROCKET FUEL COMPONENTS AT KENNEDY SPACE CENTER
R. K. Dumbauld and J. R. Bjorklund 5 May 1971 62 p refs
(Contract NAS8-26673)
(NASA-CR-61358) Avail: NTIS CSCL 21I

The results of this study represent estimates of hazard distances downwind for selected rocket fuel components from normal launches of Saturn V aerospace vehicles at Cape Kennedy. Listings of the fuel components studied, the maximum allowable concentrations for a ten-minute period considered in estimating the hazard distances, and the molecular weight of the components are provided. Calculations of concentrations for the three different meteorological situations used indicated that downwind hazard distances for normal launches of Saturn V vehicles were primarily dependent on the depth of the surface mixing layer and the vertical distribution of material in the stabilized cloud of exhaust products. A few exceptions were found, particularly with respect to the sea breeze which had a mixing depth of about 300 meters. Normalized ground-level peak and ten-minute average concentrations for the fall, spring, and sea-breeze meteorological regimes are presented. Author

N71-36104*# TRW Systems Group, Redondo Beach, Calif.
PROPELLANT QUANTITY GAUGING SYSTEM UNDER ZERO G Final Report
17 Aug. 1971 79 p
(Contract NAS8-26116)
(NASA-CR-119935) Avail: NTIS CSCL 13D

The results are presented of a study to evaluate candidate propellant gauging systems suitable for use on the space shuttle vehicle. The findings indicate that shuttle tanks with extensive surface tension screens are virtually impossible to gauge by conventional means. The only means of gauging such tanks, unless some propellant settling technique is used, appears to be by using nuclear gauging techniques for LH2 and a resonant infrasonic gauging system for LOX. A summary of the evaluation program is given along with brief technical discussions of the various gauging systems. The conclusions are outlined and recommendations are made for continued research. D.L.G.

N71-36105*# Martin Marietta Corp., Denver, Colo.
PASSIVE RETENTION/EXPULSION METHODS FOR SUBCRITICAL STORAGE OF CRYOGENS Summary Report
Jul. 1971 21 p refs
(Contract NAS9-10480)
(NASA-CR-115148; MCR-71-37) Avail: NTIS CSCL 20I

The efforts are described of a program for the design and optimization of a passive retention/expulsion system. Various passive concepts were reviewed and a dual-screen-liner(DSL) system was selected as having the best potential. A parametric study was conducted to determine the range of applicability of the DSL system, and an analytical model was devised to assist in the design analysis. Data generated during the program are presented and recommendations for further research are given. D.L.G.

N71-36106*# Martin Marietta Corp., Denver, Colo.
PASSIVE RETENTION/EXPULSION METHODS FOR SUBCRITICAL STORAGE OF CRYOGENS Final Report
Richard P. Warren, Ralph N. Eberhardt, K. C. Lunden, James R. Tegart, T. Richard Berkedale et al Jul. 1971 141 p refs
(Contract NAS9-10480)
(NASA-CR-115149; MCR-71-58) Avail: NTIS CSCL 21I

A thermal performance increase for the subcritical storage of cryogens during low g by using passive retention/ expulsion systems is discussed. Several different passive concepts are described along with the basic design studied, the so-called dual-screen-liner. The latter positions and stabilizes the liquid and gas for expulsion and venting, respectively, by the proper positioning of foraminous material within the storage tank. The desired fluid separation and control are achieved by ullage and surface tension forces acting at the surface of the foraminous material. The system is, therefore, completely passive (no moving parts) and requires no additional energy source. Author

N71-36107*# TRW Systems Group, Redondo Beach, Calif.
A PLAN FOR A MATERIAL COMPATIBILITY PROGRAM FOR OXYGEN DIFLUORIDE (OF SUB 2) AND DIBORANE (B SUB 2 H SUB 2) LIQUID PROPELLANTS Final Report, 28 Aug. 1970 - 16 Apr. 1971
J. R. Denson Apr. 1971 123 p refs Prepared for JPL
(Contracts NAS7-100; JPL-952984)
(NASA-CR-122067; TRW-16681-6009-R0-00) Avail: NTIS CSCL 21I

Candidate metallic and nonmetallic materials were selected for subjection to two years of carefully controlled and documented experimental evaluation in liquid OF2 and B2H6. A test plan was established for the experimental evaluation of candidate materials in a safe and economical manner. Included in the test plan was selection of specimen configuration, specimen combinations, specimen-container-propellant assembly, methods for transporting propellant and specimens, test facility design and operation, and methods for data acquisition and processing. Author

N71-36108# Sandia Corp., Albuquerque, N. Mex.
SOLID PROPELLANT BURN TESTS
F. L. Baker Mar. 1971 95 p Sponsored by AEC
(SC-DR-710084) Avail: NTIS

A series of solid propellant burn tests, utilizing the Titan 3 and Scout launch vehicle propellants, was conducted to provide data for a better understanding of the thermal environment that would result from such a fire. The fire test data and the analytical data utilized for deriving a thermal model are presented. Author (NSA)

N71-36109# Bureau of Mines, Bartlesville, Okla. Automotive Exhaust Emissions Program
FUEL ADDITIVES AND AUTOMOBILE EXHAUST EMISSIONS Technical Progress Report No. 40
R. D. Fleming, W. F. Marshall, and J. R. Allsup Aug. 1971 14 p refs
(TPR-40) Avail: NTIS

The influence of fuel additives on automobile exhaust

emissions was studied using engines currently found in the U.S. vehicle population. The fuel additives used in the experiment were four multifunctional additives and one lead antiknock additive. Experimental work was done to determine both the direct effect of the additive per se on exhaust emissions and the influence of long-term additive effects on emissions with mileage accumulation. Results showed no significant direct or intermediate effect on exhaust emissions for any additives tested. In subsequent experimental work concerned with the long-term or indirect effects of additives, the detergent-dispersant additives were found to have little influence on emissions when used in conjuction with high-quality oil and motor fuel. The lead (tetraethyl) antiknock additive increased exhaust hydrocarbons approximately 12 to 17 percent during a 4000-mile accumulation period using a base fuel containing 2 ml of tetraethyl lead per gallon. An unleaded fuel was used during a similar accumulation period with no significant increase in exhaust hydrocarbons with mileage. Author

N71-36110# General Applied Science Labs., Inc., Westbury, N.Y.
IGNITION AND COMBUSTION OF MULTIPHASE FUELS IN A HIGH SPEED AIR STREAM Final Technical Report
Stephen Schmotolocha and Raymond Edelman Mar. 1971 65 p refs
(Contract F44620-70-C-0042)
(AD-726639; GASL-TR-756; AFOSR-71-0933TR) Avail: NTIS CSCL 21/4

An investigation of some basic flow and combustion characteristics of storable fuels was performed. The work is concerned with the injection, mixing, and chemical reaction processes associated with direct injection of metallized slurries in a high speed air stream. Experiments were performed in a direct connect constant area combustor supplied by a Mach 2 air stream at pressure levels of approximately 1 atm. Penetration and spray formation observations were made at ambient (530R) total temperatures whereas mixing and combustion tests were performed for temperatures ranging from 1500R up to approximately 3500R. The fuels examined in the current study were a magnesium-hexane slurry and a boron-magnesium-hexane slurry. Emphasis was on the Mg/Hex slurry although some revealing preliminary tests were performed for the B/Mg/Hex fuel. The results include the observation that autoignition of the Mg/Hex slurry occurs at about 2600R total temperature and is the same as the pure hexane case; staged ignition and combustion was generally observed with the hydrocarbon igniting first, followed by the metal oxidation process; combustion efficiencies of over 90% were obtained, and the preliminary boron/magnesium/hexane tests indicate that above a certain temperature its performance is superior to the Mg/Hex slurry. Author (GRA)

28 PROPULSION SYSTEMS

Includes air breathing, electric, liquid, solid, and magneto-hydrodynamic propulsion. For nuclear propulsion see: 22 Nuclear Engineering. For basic research see: 23 Physics, General; and 33 Thermodynamics and Combustion. For applications see: 31 Space Vehicles. For related information see also: 27 Propellants.

N71-36111*# California Univ., Riverside.
AN EVALUATION OF LOX/HYDROGEN ENGINE TECHNOLOGY FOR ADVANCED MISSIONS
1 Jun. 1971 212 p refs
(Contract NAS7-790)
(NASA-CR-121864; TR-AP-71-3) Avail: NTIS CSCL 21H

The importance of engine and stage design criteria on the sizing requirements of the complete stage are quantitatively defined. They include engine parameter (i.e. chamber pressure, area ratio, and mixture ratio) optimization analyses for two engine cycles as a function of stage size and mission profile. Also, sensitivity studies were undertaken to develop influence coefficients on factors such as engine weight, number of engines, Isp efficiency, coast times, initial departure orbit inclination, and design constraints, etc. Five missions were investigated: earth orbit to synchronous orbit and return, earth orbit to lunar orbit and return, lunar orbit to lunar surface and return to lunar orbit, retro of a scientific payload into a Martian orbit, and a two-burn Mars mission in which the stage provided the interplanetary transfer velocity increment as well as the planetary orbit insertion. Author

N71-36112*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A 1000-HOUR TEST OF A DUAL GRID, ELECTROSTATIC BEAM DEFLECTION ACCELERATOR SYSTEM ON A 5-CENTIMETER-DIAMETER KAUFMAN THRUSTER
Walter C. Lathem Aug. 1971 19 p refs
(NASA-TM-X-67908; E-6518) Avail: NTIS CSCL 21C

The thruster was operated at a positive voltage of 1200 volts, negative voltage of -1200 volts and beam current of 25 mA. Beam deflection was accomplished during the first 100 hours of the test to show performance and the remainder of the test was run in the undeflected mode. Typical undeflected accelerator currents were less than 1 percent of the beam current throughout the test. Increased accelerator currents were measured at deflection angles greater than about 8-10 degrees. Author

N71-36113*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MAXIMUM PROPELLANT UTILIZATION IN AN ELECTRON-BOMBARDMENT THRUSTER
Harold R. Kaufman and Allan J. Cohen 1971 8 p refs
Presented at Symp. on Ion Sources and Formation of Ion Beams, Upton, N.Y., 19-21 Oct. 1971
(NASA-TM-X-67921; E-6554) Avail: NTIS CSCL 21C

Theoretical and experimental data on propellant utilization in electron-bombardment ion thruster are reviewed. Because the majority of investigations were conducted with mercury, the presentation emphasizes that propellant. The results are presented in as general a form as possible to facilitate use in areas other than space propulsion. Author

N71-36114*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF NEUTRALIZER POSITION ON ACCELERATOR WEAR FOR A 30 CENTIMETER DIAMETER ION BOMBARDMENT THRUSTER
R. T. Bechtel Sep. 1971 18 p refs
(NASA-TM-X-67926; E-6574) Avail: NTIS CSCL 21C

In an effort to eliminate accelerator erosion, the neutralizer position was varied with respect to the accelerator grid on a 30 centimeter diameter thruster with a glass coated accelerator grid presently being developed. Insulated stainless steel strips representing approximately 0.6 percent of the total grid area were used to measure local impingement current in the region of the groove. Extended tests were conducted at two neutralizer positions. The first position caused high local currents to the accelerator strips. In the second test this current was lower by a factor of 7. Wear measurements of the strip after these tests indicate a difference of about an order of magnitude in wear rate for the two positions. The lowest wear rate was equivalent to a total wear of less than 0.10 mm (3.9 mils) in 10,000 hours. Author

N71-36115*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
BEAM FOCUSING CHARACTERISTICS OF VARIOUSLY SHAPED GRID HOLES
David C. Byers and Bruce A. Banks Sep. 1971 36 p refs
(NASA-TM-X-67922) Avail: NTIS CSCL 21C

Tests were made to determine the ion focusing characteristics of circular, hexagonal, square, and triangular screen grid holes. The focusing was found to be dependent on both the thruster operating conditions and the screen grid hole shape and size. The circular hole shape had the lowest erosion ratios followed in increasing order by the hexagonal, square, and triangular shapes. The hexagonal hole shape appeared to be the most promising noncircular shape for high open area grids. Inspection of the erosion patterns provided a correlation between the shapes of the screen grid holes and the ion beamlet shape in the region of the accelerator grid. This correlation was used to produce square ion beamlets which could be of interest for an electrostatic beam deflection scheme. The effect of various defects in the screen grid was also investigated. Author

N71-36116*# Aerojet Liquid Rocket Co., Sacramento, Calif.
EXTENDABLE NOZZLES FOR SPACE ENGINES Final Report Addendum
30 Jul. 1971 59 p
(Contract NAS9-10484)
(NASA-CR-115133; Rept-10484-FRA) Avail: NTIS CSCL 21H

An analysis of the extendable/retractable nozzle is reported. The test included changes in step heights, the addition of auxiliary film cooling of the nozzle extension downstream of the divergent step, two sealing concepts, and nozzle deployment and retraction. Heat flux in the area of gas reattachment downstream of a rearward facing step increased significantly as the step height was increased. Nozzle performance significantly reduced as the height of a rearward-facing step was increased. Supplemental supersonic film cooling of the hot gas reattachment zone on the nozzle wall was highly effective. The static face seal is more desirable than the piston-type seal. Successful nozzle deployment and retraction were demonstrated under simulated altitude conditions. The impact of the heat transfer and performance results on the final design is discussed. N.E.N.

N71-36117*# Aerojet Solid Propulsion Co., Sacramento, Calif. Advanced Technology Operations.
DEVELOPMENT OF LOW COST ABLATIVE NOZZLES FOR LARGE SOLID PROPELLANT ROCKET MOTORS Final Report
J. D. Sohl Jan. 1971 242 p refs
(Contract NAS3-12038)
(NASA-CR-72973) Avail: NTIS CSCL 21H

The results are presented of a program to evaluate selected low-cost ablative materials at a scale and under conditions relevant to large solid-rocket motor nozzle design. Two 13-in.-dia (33 cm) nozzles were tested in the firing of Algol-sized motors. The first firing resulted in a chamber burnthrough early in the test because of an undetected flaw in the bond joint between the igniter cavity restriction and the forward boot. Valid performance data on the low-cost ablative nozzle materials were obtained from the second test. These data were used in the design of a full-scale nozzle, suitable for use on a 260-FL motor. Thermal and stress analyses were conducted on the full-scale nozzle design, which incorporates a flexible seal for TVC purposes and a 9:1 contoured exit cone. Fabrication specifications and a detailed cost estimate were also prepared for this design. Resulting data indicate that extensive use of canvas-duck phenolic and the less expensive carbon tapes results in an ablative material cost savings of about 35% compared with a similar design utilizing conventional carbon and silica phenolic composites. Author

N71-36118*# Rao (G. V. R.) and Associates, Sherman Oaks, Calif.
STUDY OF NONRADIAL STATORS FOR NOISE REDUCTION
Washington NASA Sep. 1971 85 p refs
(Contract NAS2-5730)
(NASA-CR-1882) Avail: NTIS CSCL 21E

A method of reducing rotor-stator interaction noise by the use of nonradial (leaned) stator vanes. The investigation seeks to improve theoretical treatment of vane lean effects and allow evaluation of resultant sound pressure levels in the radiated noise field. Correlation of calculated results with experimental data on a LF-336 lift fan and a small scale fan is included. Author

N71-36119*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
HIGH PRESSURE PERFORMANCE OF COMBUSTOR SEGMENTS UTILIZING PRESSURE-ATOMIZING FUEL NOZZLES AND AIR SWIRLERS FOR PRIMARY-ZONE MIXING
Robert D. Ingebo, Albert J. Doskocil, and Carl T. Norgren Washington Sep. 1971 37 p refs
(NASA-TN-D-6491; E-6156) Avail: NTIS CSCL 21E

Three rectangular combustor models, 0.457 m (18 in.) long with maximum cross sections of 0.153 by 0.305 m (6 by 12 in.), were tested at high inlet air pressures. Test conditions included: inlet air pressures of 10 to 26.7 atmospheres, inlet air temperatures of 355 to 756 K (640 to 1360 R), reference velocities of 16 to 36.6 m/sec (52.5 to 120 ft/sec), and fuel air ratios of 0.005 to 0.022. Increasing the inlet air pressure increased the smoke number, pattern factor, and liner temperature. High combustion efficiency and smoke numbers below the visible limit were obtained with combustors designed for relatively high air-flow through axial swirlers. Author

N71-36120*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
NASA TURBINE COOLING RESEARCH STATUS REPORT, 1971
John N. B. Livingood, Herman H. Ellerbrock, and Albert Kaufman Washington Sep. 1971 83 p refs
(NASA-TM-X-2384; E-6164) Avail: NTIS CSCL 21E

The turbine cooling program, including research in progress and research being performed for Lewis, is discussed. The report represents the status of work through April 1971. From comparisons of predicted and experimental results, areas requiring further research efforts are identified. Flow, heat-transfer structure, and life considerations are presented. Cooling concepts for application to future aircraft engines are also discussed. Author

N71-36121# ARO, Inc., Arnold Air Force Station, Tenn.
EXPERIMENTAL STUDY OF SIMULATED HIGH ALTITUDE ROCKET EXHAUST PLUMES Final Report, 18 Feb. - 1 May 1970
Wendell Norman, Max Kinslow, and J. W. L. Lewis Jul. 1971 180 p refs
(Contract F40600-71-C-0002)
(AD-726555; AEDC-TR-71-25) Avail: NTIS CSCL 21/2

The gas dynamic structure of high altitude rocket plumes has been studied in a low density tunnel to obtain basic data on plume size and shape and to determine the extent of the mixing region between the free-stream and rocket gases. The rocket was simulated by specially designed ejectors using helium and CO2 as the gases, with conditions chosen to simulate a 100,000-lb-thrust rocket at an altitude of 90 km. Data taken included impact pressure surveys, density measurements of the free-stream and plume gas, temperature measurements, and color photographs. The last three of these were taken using electron beam techniques. The result of the study is a set of basic data. Analysis and interpretation of the data will be performed under a separate study. Author (GRA)

N71-36122# ARO, Inc., Arnold Air Force Station, Tenn.
A NONINTERFERENCE METHOD FOR DETERMINING TEMPERATURE AND WATER VAPOR CONCENTRATION PROFILES IN CYLINDRICALLY SYMMETRICAL COMBUSTION SYSTEMS Final Report
L. E. Brewer AEDC Jul. 1971 24 p refs
(Contract F40600-71-C-0002)

(AD-726554; AEDC-TR-71-80) Avail: NTIS CSCL 21/2

An optical method to determine radial temperature and water vapor concentration profiles from a radiating combustion source is presented. Equations for radiance and transmissivity using the random band model with constant line widths and a delta-function distribution for line strengths are written for a hypothetical cylindrically symmetrical source. A numerical iterative technique of solution of these equations for temperature and water vapor concentration from measured radiance and transmittance profiles is presented, utilizing band model parameter data from the literature. Experimental data from a small hydrogen-air burner are used to verify the analytical treatment. Author (GRA)

N71-36123# Flight Dynamics Research Corp., Burbank, Calif.
A JET FLAP DIFFUSER EJECTOR Final Report, Jun. 1970 - May 1971
Morton Alperin and Gary L. Mariotte Wright-Patterson AFB, Ohio AFFDL Jun. 1971 168 p refs
(Contract F33615-70-C-1656)
(AD-726596; TR-71-06-01; AFFDL-TR-71-66) Avail: NTIS CSCL 21/8

The use of a jet flap diffuser for recovery of ejector jet kinetic energy has been investigated in a two-dimensional experiment, utilizing an ejector which employs a Coanda inlet for ninety degree rotation of the primary flow. Performance is compared to a solid diffuser ejector of the equivalent power and channel width. The jet flap diffuser ejector appears to have an advantage over solid diffuser ejectors for the rapid application of additional thrust for control purposes, as well as for the utilization of engine power in the production of propulsive energy. Author (GRA)

N71-36124# Air Force Systems Command, Wright-Patterson AFB, Ohio.
INVESTIGATION OF THE STRESSED STATE OF COOLED TURBINE BLADES OF THE SHELL TYPE
Yu. M. Matsevityi 12 Mar. 1971 12 p refs Transl. into ENGLISH from Termoprochnost Materialov i Konstrucki. Elementov Sbornik (USSR), no. 5, 1969 p 245-249
(AD-726601; FTD-HT-23-121-71) Avail: NTIS CSCL 21/5

A description is given of a technique for determining the temperature field of internally cooled blades of gas turbines. The technique uses an integrator in combination with a coordinating device which measures the temperature gradient in the blade body during cooling. Approximate values of the normal stresses developing in the turbine blades during cooling can be obtained by this technique. Author (GRA)

N71-36125# Sundstrand Aviation-Rockford, Ill.
AN EXPERIMENTAL STUDY OF NOZZLES AND SPECIFIC HEAT RATIO EFFECTS ON OFF-DESIGN PERFORMANCE OF PARTIAL ADMISSION TURBINES Final Report
Robert S. Peterson and Steven C. Peskovich 14 Jun. 1971 246 p refs
(Contract N00014-68-C-0406)
(AD-726723; SA/ATR-2001) Avail: NTIS CSCL 21/5

The report covers experimental work performed to determine the effect of nozzle divergence angle, specific heat ratio and plug nozzle configuration on turbine nozzle performance. Off design performance was the primary area of investigation. The effect of nozzle divergence angle was investigated with conical and contoured nozzles for two Mach numbers over a range of speed and pressure ratios. The performance of selected plug nozzle geometries was measured over a range of speed and pressure ratios. The influence on performance of the gas specific heat ratios was experimentally determined by testing the same nozzle with gases of different specific heat ratios. The reduced experimental data is presented in tabular form as well as graphic presentation in several formats. Author (GRA)

N71-36126# Aerospace Research Labs., Wright-Patterson AFB, Ohio. Aerospace Research Labs.
THE DESIGN OF AN AXIAL COMPRESSOR STAGE FOR A TOTAL PRESSURE RATIO OF 3 TO 1 Final Report
Arthur J. Wennerstrom and Richard M. Hearsey Mar. 1971 180 p refs
(AD-727001; ARL-71-0061) Avail: NTIS CSCL 13/7

The report describes in detail the aerodynamic design of a supersonic axial compressor stage. The principal design-point characteristics of the stage are a corrected tip speed of 1600 ft/sec, an inlet hub/tip radius ratio of 0.75, a total pressure ratio of 3.0, and an isentropic efficiency of 82%. Four features distinguish this stage from other reported stages. A new type of rotor airfoil is employed. The stator leading edges are swept back from both walls toward mid-passage. Unusually large and variable fillet radii blend blades with platforms. Also, a new and precise technique was used to determine Cartesian manufacturing coordinates for the airfoils, aerodynamically defined on streamsurfaces. The preliminary design employed a technique resulting in equilibrium radial distributions of loss coefficient and flow angle which are fully consistent with relative Mach numbers and diffusion factors for each blade row and on each streamsurface according to a prescribed loss model. The detail design was accomplished using computing stations internal as well as external to both blade rows and attempted to optimize the axial distribution of static pressure. Author (GRA)

N71-36271*# MacNeal-Schwendler Corp., San Marino, Calif.
ACOUSTIC ANALYSIS OF SOLID ROCKET MOTOR CAVITIES BY A FINITE ELEMENT METHOD
David N. Herting, Jerrard A. Joseph, Loren R. Kuusinen, and Richard H. MacNeal *In* NASA. Langley Res. Center NASTRAN: Users Experiences Sep. 1971 p 285-324 refs
(See N71-36253 22-32)
Avail: NTIS HC $9.00/MF $0.95 CSCL 21H

29 SPACE RADIATION

Includes cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts. For related information see also: 13 Geophysics; and 24 Physics, Atomic, Molecular, and Nuclear.

N71-36127*# National Aeronautics and Space Administration. Goddard Inst. for Space Studies, New York.
RADIO SPECTRUM OF TWO ACTIVE REGIONS (RESULTS OF THE TOTAL SOLAR ECLIPSE OF 12 NOV. 1966)
Franca Chiuderi Drago [1970] 30 p refs
(NASA-TM-X-66543) Avail: NTIS CSCL 03B

The results of the total solar eclipse of November 12, 1966, observed at 8 different wavelengths between 3 and 21 cm, were studied and the spectrum of two active regions present on the disk was deduced. The shape of the more intense source spectrum presents a maximum at lambda approximately 10 cm indicating, at first sight, the nonthermal origin of the emission; it is then shown that the observed flux increase with the wavelength is completely due to geometrical effects. From the Laplace transform of the brightness temperature of the source, the mean and central temperature of the coronal condensation and the integral of (N sq) dh for the corona (N = electron density) are deduced. Author

N71-36128*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ORIGIN OF COSMIC ELECTRONS FROM ABOUT 100 TO 1000000 GeV
R. Ramaty and R. E. Lingenfelter Aug. 1971 11 p refs Submitted for publication
(NASA-TM-X-65689; X-660-71-350) Avail: NTIS CSCL 03B

The origin of high energy cosmic electrons is considered. It

was found that electrons of energies < or = 1000 GeV could have been produced by local supernovae associated with known radio remnants. At higher energies, observations of muon-poor air showers indicate the existence of electrons at 1 million GeV which may have been originated entirely from the supernova Vela X. Author

N71-36129*# Aeronautical Research Associates of Princeton, Inc., N.J.
THEORETICAL INTERPRETATION OF COSMIC RAY PHENOMENA Final Report
Jul. 1971 43 p refs
(Contract NAS9-9515)
(NASA-CR-115178) Avail: NTIS CSCL 03B

Several numerical and analytical approximation techniques for obtaining solutions to cosmic ray flux equations were developed. The numerical Laplace transform inversion and the analytic extension methods seem the most promising. The cosmic ray transport in the turbulent interplanetary and in interstellar plasmas is also discussed. Author

N71-36130*# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
IMP-D AND IMP-E, EXPLORER 33 AND EXPLORER 35 Final Report
Jan. 1970 95 p
(Contract NAS5-9076)
(NASA-CR-121895) Avail: NTIS CSCL 03B

A bibliography of publications as of January 1970 on Explorer 33 and 35 and a compilation of abstracts or first pages of each item in the bibliography are presented. Author

N71-36131# National Physical Lab., New Delhi (India). Radio Science Div.
IONOSPHERIC EFFECTS OF SOLAR FLARES. 5: THE FLARE EVENT OF JANUARY 30, 1968 AND ITS IMPLICATIONS
S. D. Deshpande, S. Ganguly, V. C. Jain, and A. P. Mitra Apr. 1971 33 p refs
(RSD-63; PL-480-11) Avail: NTIS

From riometer and pulse absorption measurements on three frequencies for the large X-ray flare event that occurred on 30 January 1968, electron density profiles were derived for the entire course of the flare. The time variation of the electron production rate was obtained for the event from satellite measurements of X-rays in the bands 0-3 A, 0-8 A and 8-20 A. A comparison of the profiles with the electron production rates deduced from the X-rays revealed a decrease in the effective recombination coefficient or of the negative ion to electron ratio, which is in agreement with other results. Author

N71-36132# National Physical Lab., New Delhi (India). Radio Science Div.
IONOSPHERIC EFFECTS OF SOLAR FLARES. 4: ELECTRON DENSITY PROFILES FROM OBSERVATIONS OF SCNA AND VLF PHASE AND AMPLITUDE
S. D. Deshpande and A. P. Mitra Apr. 1971 27 p refs Supported by ESSA
(RSD-62; PL-480-10; SR-62) Avail: NTIS

A method is presented by which electron density profiles in D region of the ionosphere may be derived during solar flares from: (1) SCNA measurements at two frequencies and (2) simultaneous measurements of SCNAs and SPAs at VLF. A parabolic profile is assumed. At lower levels, the profile is estimated from the measurements of phase and amplitude changes at VLF. Profiles are obtained for a number of flare events, and are compared with those derived by cross-modulation, partial reflection and rocket techniques. Author

N71-36133# National Physical Lab., New Delhi (India). Radio Science Div.
IONOSPHERIC EFFECTS OF SOLAR FLARES. 3: A QUANTITATIVE STUDY OF FLARE X-RAY-SID RELATIONSHIP
S. D. Deshpande and A. P. Mitra Apr. 1971 21 p refs
(RSD-61; PL-480-9) Avail: NTIS

The effects are described of changes in the spectral distribution of solar X-rays below 10 A, on the nature and magnitude of sudden cosmic noise absorptions (SCNAs), and the results of a quantitative comparison of 50 SCNAs with X-ray flares for which spectral distributions could be deduced. It was observed that the SCNA increases by an order of magnitude when the equivalent spectral temperature increases from 2 x 10 to the 10th power K to 8 x 10 to the 7th power K even though the total X-ray flux below 10 A was kept constant. It was further observed, from an examination of the threshold case and from a quantitative study of 50 flare events, that the required recombination coefficients in the region 70-90 km are considerably lower than those given by Reid, and that these generally fall into one of three categories: one very low; relatively high with values around 0.00002 cu cm/sec at 70 km and 0.000004 cu cm/sec at 80 km; and intermediate between the two. It is suggested that Reid's recombination coefficient model, which is not consistent with any of the flare models, represents the quiet time situation and that during the flare there is a decrease in the coefficient. Author

N71-36134# National Physical Lab., New Delhi (India). Radio Science Div.
IONOSPHERIC EFFECTS OF SOLAR FLARES. 2: INFORMATION ON FLARE X-RAY SPECTRUM BELOW 10A OBTAINED FROM SATELLITE BORNE DETECTOR RESPONSE
S. D. Deshpande and A. P. Mitra Feb. 1971 28 p refs
(RSD-60; PL-480-8) Avail: NTIS

The spectral distribution and its time development for X-rays below 10 A during solar flares were deduced from the measurements of integrated flux levels by satellite-borne detectors in the 0.5-3 A and 1-8 A bands. An exponential distribution and a power law distribution were considered, as well as a composite spectrum with two different electron temperatures in the bands 0.5-3 A and 3-8 A. Analysis of X-ray response for selected flare events gave spectral temperatures of about (1-3) x 10 to the 7th power K for lambda < 3 A and about (8-10) x 10 to the 6th power K for lambda < 3 A. The power law representation gave a distribution of lambda to the mth power, with m having values between 1-2 at the peak of the flare. Gradual changes in spectral temperatures are shown for some events. Author

N71-36135# National Physical Lab., New Delhi (India). Radio Science Div.
IONOSPHERIC EFFECTS OF SOLAR FLARES. 1: A STATISTICAL EXAMINATION OF X-RAY FLARE-SID RELATIONSHIP
S. D. Deshpande, C. V. Subrahmanyam, and A. P. Mitra Feb. 1971 36 p refs
(RSD-59; PL-480-7) Avail: NTIS

The sudden ionospheric disturbances (SID) produced in the earth's ionosphere by enhanced solar radiation during solar flares were examined in the light of information of flare X-ray emission. The SIDs covered the VLF-LF as well as HF effects. It was found that the occurrence probability of SIDs with X-ray flares increases as the emission extends toward the shorter end of the X-ray spectrum. An X-ray enhancement concurrent with both H sub alpha and radio events is generally large and is capable of producing all SID effects including the sudden frequency deviations (SFD) and a crochet in 80% of the cases. A threshold flux of 0.001 erg/sq cm-sec in the 0-8 A band and a threshold ratio of 0-3 A to 0-8 A flux level of 0.015 is sufficient to produce a detectable SID effect. The size of an SID effect increases with X-ray enhancements in 0-3 A, 0-8 A, and 2-12 A bands, but the relationship is not linear. The relaxation time of most SID effects (excluding SFD) with reference to X-ray flares in the bands is 2 to 3 minutes. Author

N71-36136# Aerospace Corp., El Segundo, Calif. Lab. Operations.
A FLIGHT CALIBRATION DEVICE FOR ABSOLUTE MEASUREMENTS AT THE LYMAN-ALPHA WAVELENGTH
Paul H. Metzger and Malcolm A. Clark 12 Jun. 1971 18 p refs
(Contract F04701-70-C-0059)
(AD-726567; TR-0059(6260-10)-9; SAMSO-TR-71-36) Avail: NTIS CSCL 20/6

A small device consisting of a lamp, filter, and external photodiode has been used successfully to monitor the sensitivity of a Lyman-alpha photometer on OGO-6 as well as a number of Air Force satellites. The operation of this calibration device is independent of lamp, filter, or window decay. Author (GRA)

N71-36137# Aerospace Corp., El Segundo, Calif. Space Physics Lab.
COMPILATION OF OV3-3 SCIENTIFIC RESULTS
J. Bernard Blake 15 Jun. 1971 556 p refs
(Contract F04701-70-C-0059)
(AD-726542; TR-0059(6260-20)-16; SAMSO-TR-71-117) Avail: NTIS CSCL 04/1

The compilation contains copies of all scientific publications published up to January 1971 in which OV3-3 data were used wholly or in part. In addition, a description of the OV3-3 spacecraft is included. Author (GRA)

N71-36138# Aerospace Corp., El Segundo, Calif. Space Physics Lab.
POLAR IONOSPHERE MEASURED ION DENSITY ENHANCEMENTS AND SOFT ELECTRON PRECIPITATION
Technical Report, Jul. 1968 - May 1971
Frederick A. Morse, Henry H. Hilton, and Paul F. Mizera 15 Jun. 1971 49 p refs
(Contract F04701-70-C-0059)
(AD-726541; TR-0059(6260-10)-7; SAMSO-TR-71-133) Avail: NTIS CSCL 04/1

The experiment complement aboard a polar satellite having a perigee near 160 km and initial apogee near 1800 km included an ion trap and sensors for low energy electrons and protons. The data from these two experiments have been correlated for the period August 13-18, 1968, during which time the perigee invariant latitude was > or = 70 deg. Results of these studies for the polar region are: The large ion density enhancements observed are correlated with simultaneously observed enhancements in the precipitating fluxes of low energy electrons. The trough and ionospheric enhancements are shown to occur below as well as above the F-Region maximum density height. It is concluded that the position of the midlatitude trough minimum should not be expected to show a simple relationship with magnetic indices since the shape depends on the local precipitation (ionization) patterns; the total energy input, is time and spatial extent; diffusion rates of the ionized species; universal time; and altitude of the observations. Author (GRA)

N71-36139 California Inst. of Tech., Pasadena.
THE MOLECULAR SPECTRUM OF SUNSPOTS
John Clinton Webber (Ph.D. Thesis) 1970 80 p
Avail: Univ. Microfilms Order No. 70-18050

Photographic spectrograms were obtained for three different sunspots under carefully selected seeing conditions, showing molecular absorption lines due to MgH, CaH, and TiO. Analysis led to estimates of the effective rotational temperatures of each. In the case of CaH, no definite conclusions could be drawn. Predicted rotational temperatures and observational f-values were calculated on the basis of model umbral atmospheres due to several authors. A new model was derived from the molecular lines and shown to differ widely from previous models. The usefulness of photographic spectra for this purpose is seriously questioned, and suggestions are made for new observations.
Dissert. Abstr.

N71-36229# Bulgarian Academy of Science, Sofia.
CERTAIN ASPECTS OF THE INFLUENCE OF SOLAR ACTIVITY ON ATMOSPHERIC DENSITY
M. Kalinkov *In* Polish Acad. of Sci. Observations of Artificial Earth Satellites, no. 9, 1969 1970 p 217-228 refs In RUSSIAN; ENGLISH summary (See N71-36206 22-31)
Avail: NTIS

N71-36229# Academy of Sciences (USSR), Moscow.
THE CAUSE OF THE 14-DAY HEAT FLUCTUATIONS IN THE EARTH'S UPPER ATMOSPHERE: VARIATIONS IN SOFT SOLAR X RADIATION OF 40-100 A
V. Ye. Chertoprud *In* Polish Acad. of Sci. Observations of Artificial Earth Satellites, no. 9, 1969 1970 p 229-245 refs In RUSSIAN; ENGLISH summary (See N71-36206 22-31)
Avail: NTIS

N71-35475# Paris Univ. (France). Lab. of Oceanographic Physics.
REPORT OF THE SCOR-UNESCO WORKING GROUP NO. 15 ON RADIATIVE ENERGY IN OCEANS [LES TRAVAUX DU GROUPE DE TRAVAIL NO. 15 DU SCOR-UNESCO SUR LA MESURE DE L'ENERGIE RAYONNANTE DANS LES OCEANS]
Ivanoff *In* Assoc. Franc. pour l'Etude et le Develop. des Appl. de l'Energie Solaire Meas. of Solar Energy in Ocean Waters and Ocean Productivity 23 May 1971 9 p In FRENCH (See N71-35472 22-13)
Avail: NTIS

30 SPACE SCIENCES

Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbit and trajectory. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles.

N71-36140*# IIT Research Inst., Chicago, Ill.
TRAJECTORY AND PROPULSION CHARACTERISTICS OF COMET RENDEZVOUS OPPORTUNITIES
A. L. Friedlander, J. C. Nishoff, and J. I. Waters Aug. 1970 192 p refs
(Contract NASw-2023)
(NASA-CR-121782; T-25) Avail: NTIS CSCL 22A

Spacecraft mission opportunities to short-period comets in the time period 1975-95 are examined. Results are presented for promising rendezvous mission opportunities and flight modes from the standpoint of trajectory requirements and launch vehicle/payload capabilities. A broad-brush treatment of wide scope underlies the analysis. Selection criteria leading to 16 comet apparitions for study are described. The candidate flight modes considered include: 3-impulse ballistic transfers, Jupiter gravity-assist transfers, solar-electric and nuclear-electric lowthrust transfers. Results show that the best early opportunities are Comets Encke/80, d'Arrest/82 and Kopff/83. Although these missions can be performed ballistically, solar-electric low-thrust propulsions offers greatly improved performance, i.e. shorter flight times and smaller launch vehicles. Particles accomplishment of the very difficult Halley rendezvous depends upon the development of nuclear-electric propulsion by 1983. Author

N71-36141*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
TWO COMPUTERIZED STREAM SEARCHES AMONG METEOR ORBITS: AMONG 885 PRECISE PHOTOGRAPHIC ORBITS; AMONG 2401 PHOTOGRAPHIC ORBITS
Bertil-Anders Lindblad Washington 1971 27 p refs

Sponsored by NASA Its Contrib. to Astrophys. No. 12
(NASA-CR-121922) Avail: NTIS; SOD $0.40 CSCL 03A

CONTENTS:

1. A STREAM SEARCH AMONG 865 PRECISE PHOTOGRAPHIC METEOR ORBITS (Lund Obs.) p 1-13 refs (See N71-36142 22-30)

2. A COMPUTERIZED STREAM SEARCH AMONG 2401 PHOTOGRAPHIC METEOR ORBITS (Lund Obs.) p 14-24 refs (See N71-36143 22-30)

N71-36142*# Lund Observatory (Sweden).
A STREAM SEARCH AMONG 865 PRECISE PHOTOGRAPHIC METEOR ORBITS
In Smithsonian Astrophys. Obs. Two Computerized Stream Searches Among Meteor Orbits 1971 p 1-13: refs (See N71-36141 22-30)
(Contracts NSR-09-015-033; NSR-22-007-010; Grants NSF G-20135; NSF G-388)
Avail: NTIS; SOD $0.40 CSCL 03A

A search for meteor streams was made among photographic meteor orbits collected in the Harvard Meteor Program, utilizing an automatic computer program. In all, 80 meteor streams were detected. Of these, 21 represent 19 previously known, well-studied photographic meteor showers and 17 represent new meteor streams. Five previously unstudied photographic streams with four or more members were discovered. Of these, three were identified with streams reported by visual observers. Of the remaining streams, 8 have 3 members and 29 have only 2 members. About half the 2- and 3-member streams are believed to be spurious. A comparison of these streams with the meteor associations of Jacchia and Whipple indicate similar statistical properties, but few individual agreements are noticed. Author

N71-36143*# Lund Observatory (Sweden).
A COMPUTERIZED STREAM SEARCH AMONG 2401 PHOTOGRAPHIC METEOR ORBITS
In Smithsonian Astrophys. Obs. Two computerized Stream Searches Among Meteor Orbits 1971 p 14-24 refs (See N71-36141 22-30)
(Contract NSR-09-015-033)
Avail: NTIS; SOD $0.40 CSCL 03A

For known photographic streams, the mean orbital elements as determined by the search are similar to those previously obtained by conventional methods of stream classification. Many new photographic meteor streams were detected. The extensive Leonid-Virginid photographic stream is identified with Hoffmeister's Virginid stream; identifications with other ecliptical currents are also suggested. Several streams are split into a northern and a southern branch, with their orbital planes symmetrical with respect to the plane of the ecliptic. Four streams move in orbits similar to those of comets: the mu Sagittarid is associated with Comet Lexell (1770 I), the tau Herculid very probably with comet Schwassman-Wachmann (1930 VI), the December Monocerotid with Comet Mellish (1917 I), and the zeta Arietid with Comet Schmidt-Temple (1862 II). Porter's list of comets gives the first three associations as predicted but not observed. Author

N71-36144*# Denver Univ., Colo. Dept. of Physics.
HYDROMAGNETIC WAVE RESONANCES IN THE MAGNETOSPHERE
V. L. Patel Aug. 1971 25 p refs Presented at the 15th Gen. Assembly of IUGG, Moscow, Aug. 1971
(Grant NGR-06-004-058)
(NASA-CR-121987; DU-7103) Avail: NTIS CSCL 03B

Theoretical and observational research on the hydromagnetic wave resonances in the magnetosphere is reviewed. The magnetosphere is divided into three regions: 1) the plasmasphere, 2) the outer magnetosphere, and 3) the magnetospheric tail. Applicable theoretical models in each of these regions are discussed. Observations of the resonant periods in several satellite experiments are compared with the models and predominant resonance periods in these regions are suggested. Observed resonance periods and the size of the resonating regions are discussed for a possible use as diagnostics of the magnetosphere. Author

N71-36145*# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
RESEARCH IN SPACE PHYSICS AT THE UNIVERSITY OF IOWA Annual Report, 1971
J. A. Van Allen 19 Aug. 1971 26 p refs
(Grant NGL-16-001-002)
(NASA-CR-121988) Avail: NTIS CSCL 03B

Investigative emphasis was placed on the following: (1) detection and interpretive analysis of all energetic particles trapped in the earth's magnetic field and transiently present in outer magnetosphere, (2) propagation of galactic cosmic rays and energetic electrons, protons, alpha particles, and heavier nuclei emitted by the sun; (3) radio frequency emissions and soft X-radiation from quiescent and flaring sun; (4) origin and propagation of VLF radio waves in magnetosphere and ionosphere; (5) shock waves in the interplanetary medium; (6) theory of wave phenomena in turbulent plasmas and origin of superthermal particles; (7) dekametric radio emissions from Jupiter and their relationship to its magnetosphere; and (8) magnetosphere and magnetic field of Jupiter and search for magnetospheres of Saturn, Uranus, Neptune, and Pluto. A.L

N71-36146*# Wisconsin Univ., Madison. Dept. of Physics.
INTERSTELLAR HELIUM IN INTERPLANETARY SPACE
Wm. F. Feldman, J. J. Lange, and F. Sherb [1971] 43 p refs
(Grants NGR-50-002-044; NGR-50-002-162)
(NASA-CR-121902) Avail: NTIS CSCL 03B

The orbits of interstellar He(+) ions injected into an ideal (noise-free) Archimedean spiral magnetic field are considered. The He(+) ions originate from infalling interstellar wind neutral He atoms which are ionized in the interplanetary medium. The velocity distribution function of He(+), expected at 1 AU as a function of azimuthal position phi in the ecliptic for different interstellar wind parameters, is determined. The orbits of atoms or molecules which escape from solar system bodies and are ionized in interplanetary space are also given. An example of such a source could be neutral hydrogen ionized beyond the disturbed interface between the Venusian ionosphere and the solar wind. Detection and identification of such particles could yield information concerning atmospheric abundances and thermalization processes in the solar wind. Finally, the various interpretations of infalling neutral He within the interplanetary medium are compared. Author

N71-36147*# California Univ., Berkeley. Space Sciences Lab.
A PULSING X-RAY SOURCE IN CIRCINUS
Bruce Margon, Michael Lampton, Stuart Bowyer, and Ray Cruddace [1971] 8 p refs *Its* Series 12 Issue 59
(Grant NGR-05-003-278)
(NASA-CR-121989) Avail: NTIS CSCL 03A

A pulsing X-ray source with period 695 + or - 30 ms has been observed in Circinus. Approximately 10% of the 1 to 10 keV X-ray emission of the source is contained in these pulses. A spectrum of the source is presented, and may be fit by a thermal bremsstrahlung emission mechanism with T = 3.5 x 10 to the 7th power K, or by a black body at T = 1.1 x 10 to the 7th power K, both subject to heavy absorption. Author

N71-36148*# Geological Survey, Washington, D.C.
PRELIMINARY DOCUMENTATION OF THE APOLLO 15 SAMPLES
R. L. Sutton, M. H. Hait, E. W. Wolfe, R. M. Batson, N. G. Bailey et al 26 Aug. 1971 168 p
(NASA Order T-65253-G)
(NASA-CR-121991; Rept-34) Avail: NTIS

Locations of the documented samples returned by Apollo

15 are illustrated. Photographic coverage of sample sites, crew descriptions, general rock types, and numbering systems are included. Sample locations were determined from lunar surface photographs, from video tape recordings, from descriptions by the astronauts at the time of sampling, and debriefings after their return; and from correlation between the sample bags in which the samples were returned and the traverse locations where those bags were used. Author

N71-36149*# Geological Survey, Washington, D.C.
PRELIMINARY CATALOG OF PICTURES TAKEN ON THE LUNAR SURFACE DURING THE APOLLO 15 MISSION
R. M. Batson, K. B. Larson, V. S. Reed, J. J. Rennilson (California Inst. of Tech.), R. L. Sutton et al 27 Aug. 1971 63 p
(NASA Order T-65253-G)
(NASA-CR-121908; Rept-35) Avail: NTIS CSCL 14E

A catalog is presented of all pictures taken from the lunar module or the lunar surface with electric Hasselblad cameras on 70 mm film. Individual tables given include (1) film usage on the lunar surface, (2) chronological listing of 60 mm lunar surface pictures, (3) sequential listing within each magazine of 60 mm lunar surface pictures, (4) chronological listing of 500 mm lunar surface pictures, (5) 500 mm stereoscopic pictures, and (6) lunar surface film usage by camera number. D.L.G.

N71-36150*# Bureau of Mines, Minneapolis, Minn.
MULTIDISCIPLINARY RESEARCH LEADING TO UTILIZATION OF EXTRATERRESTRIAL RESOURCES Annual Status Report, Fiscal Year 1971
David E. Fogelson 1 Jul. 1971 23 p refs
(NASA Order R-09-040-001)
(NASA-CR-121915) Avail: NTIS CSCL 03B

Research is reported on rock and mineral studies in simulated lunar environment. (1) The major emphasis of the surface properties group was on the completion of vane-sheer testing. Friction system reproducibility was increased, and tests on mineral/mineral and mineral/metal pairs are reported. (2) The capability of the rock compression testing system was extended to include lunar day temperatures, and information from optical data processing was compared with that from microscopic analysis. Brazilian and point load tests on gabbro and micrographs of flood basalt and dacite are described. (3) The ultrahigh vacuum system for thermal property measurements was completed. (4) Instrumentation for the large-scale vacuum facility for testing chemical explosives was designed and installed. (5) Shear strength values of simulated lunar soil appear identical to those for earth conditions, and the shear strain rates seem to influence on the peak values. A preliminary finite element program was developed for determining initial stress conditions in typical gravity flow bins and hoppers. N.E.N.

N71-36151*# Scientific Translation Service, Santa Barbara, Calif.
POLAR ASYMMETRY OF THE PLANETS [POLARNAYA ASIMMETRIYA PLANET]
P. V. Florenskiy et al Washington NASA Sep. 1971 13 p refs Transl. into ENGLISH from Priroda (Moscow), no. 6, 1971 p 68-72
(Contract NASw-2035)
(NASA-TT-F-13933) Avail: NTIS CSCL 03B

The polar asymmetry found in formations on the earth and on the other planets is discussed. Hypotheses on the reasons for the asymmetry are presented. Author

N71-36152*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ON THE TIDAL EFFECTS IN THE MOTION OF ARTIFICIAL SATELLITES
Peter Musen and Ronald Estes Aug. 1971 40 p refs
(NASA-TM-X-65685; X-550-71-341) Avail: NTIS CSCL 22C

The general perturbations in the elliptic and vectorial elements of a satellite as caused by the tidal deformations of the nonspherical earth are developed into trigonometric series in the standard ecliptical arguments of Hill-Brown lunar theory and in the equatorial elements of the satellite. The integration of the differential equations for variation of elements of the satellite in this theory is easy because all arguments are linear or nearly linear in time. The trigonometrical expansion permits a judgment about the relative significance of the amplitudes and periods of different tidal waves over a long period of time. Graphs are presented of the tidal perturbations in the elliptic elements of the BE-C satellite which illustrate long term periodic behavior. The tidal effects are clearly noticeable in the observations and their comparison with the theory permits improvement of the global Love numbers for the earth. Author

N71-36153*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ERTS IMAGE BOUNDARIES
Gerald J. Grebowsky Jul. 1971 27 p
(NASA-TM-X-65684; X-560-71-309) Avail: NTIS CSCL 14E

Since the scanning of a ground scene is accomplished by different techniques in the Earth Resources Technology Satellite (ERTS) Multi-Spectral Scanner (MSS) and Return Beam Vidicon (RBV) systems, the boundaries of an MSS image and RBV image will not be the same. The study discussed was intended to define the image boundaries and the changes in these boundaries due to variations in the position and orientation of the ERTS spacecraft. Quantitative results are derived for the nominal case with perfect attitude control and for expected worst case effects of attitude variations. Author

N71-36154*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A POSSIBILITY OF MULTIPLE EXOSPHERIC TEMPERATURES FOR VENUS AND MARS
J. R. Herman Sep. 1971 17 p refs Submitted for publication
(NASA-TM-X-65690; X-621-71-354) Avail: NTIS CSCL 03B

Solutions of the heat transport equations for each of the important neutral species in the upper atmosphere of Venus and Mars have shown that multiple neutral temperatures must be considered to properly understand the distribution of atomic hydrogen. Temperature differences between CO2 and the light atomic species, H, D, and He in excess of 100 K for Venus and 50 K for Mars are obtained above the exobase. The magnitude and separation of these temperatures depend strongly on the relative proportion of light neutrals to carbon dioxide in the lower atmosphere and on the degree of turbulent mixing in the lower thermosphere (above 100 km). Since the atomic hydrogen effusion flux is strongly dependent on the exobase temperature, the exospheric hydrogen density is found to be very different from that based on the CO2 temperature. The exospheric atomic hydrogen density is found to have a power law dependence on the proportion of neutral helium present in the atmosphere. Author

N71-36155*# TRW Systems Group, Redondo Beach, Calif.
STUDY OF ROCK EXPERIMENTS TO MEASURE INTERPLANETARY ENERGETIC HYDROGEN FLUXES AND HYDROGEN FLUXES DURING AN AURORAL BREAKUP Final Report
R. L. Wax 2 Jul. 1971 21 p refs
(Contract NASw-2161)
(NASA-CR-121934; TRW-17241-6003-RO-00) Avail: NTIS CSCL 03B

The results of the Nike Tomahawk auroral hydrogen experiment are presented. The rocket was flown with 12 separate instruments to perform comprehensive measurements of the flux, energy spectra, and pitch angle distributions of precipitated low energy hydrogen (positive, negative, and neutral) and electrons, and to identify the occurrence of fast temporal variations in these parameters. Swept analyzers provided details of the particle energy spectra; fixed energy analyzers investigated rapid temporal variations, pitch angle distributions, and possible

transit time delays between the hydrogen and electron precipitation and also between particles of the same type but of different energy. Author

N71-36156*# Scientific Translation Service, Santa Barbara, Calif.
ON THE PHASE DEPENDENCE OF INTEGRAL BRIGHT DEPENDENCE OF INTEGRAL BRIGHTNESS OF MARS [O FAZOVOY ZAVISIMOSTI INTEGRALNOGO BLESKA MARSA]
N. P. Barbashov et al Washington NASA Sep. 1971 10 p refs Transl. into ENGLISH from Astron. Zh. (Moscow) v. 48, no. 3, 1971 p 581-586
(Contract NASw-2035)
(NASA-TT-F-13973) Avail: NTIS CSCL 03B

Results of the statistical processing of the phase dependence of Mars brightness in the spectral region between 0.3 and 1.1 micron are given. The brightness variations with the longitude of the central meridian are analyzed. It was found that reflectivity of Mars falls down quickly between 0.4 and 0.6 micron, and the law of reflection from the Martian surface changes in this spectral region. Author

N71-36157*# TRW Systems Group, Houston, Tex.
MONTE CARLO DIRECT SIMULATION TECHNIQUE USER'S MANUAL
F. W. Vogenitz, G. Y. Takata, A. J. Kessler, D. R. Crawford, P. Feldman et al 12 Jul. 1971 130 p refs
(Contract NAS9-11207)
(NASA-CR-115151; TRW-16208-001-R0-00) Avail: NTIS CSCL 22C

The user's manual is presented for the Monte Carlo direct simulation technique with a set of 1108 computer programs which describe the rarefied flow field around various bodies reentering the earths atmosphere at high angle of attack. The programs were developed in a study of reentry flow fields around various surfaces representative of the MSC space shuttle orbiter vehicle. Seven Monte Carlo flow field programs are described: SLAB, DRUM SLAB 1 and DRUM SLAB 2 (for flat plates), ORBITER, DRUM ORBITER 1 and DRUM ORBITER 2 (for orbiter fuselage cross section), and 3-D (for a 3-D representation of orbiter). A general description of the Monte Carlo technique is given in the user's manual together with a relationship of the technique to the Boltzmann Equation. A description of parameters are given together with input descriptions, input forms, dimension statements, flow charts, and output descriptions for each of the programs. Author

N71-36158*# Massachusetts Inst. of Tech., Cambridge. Charles Stark Draper Lab.
APPROXIMATE OPTIMAL ATMOSPHERIC ENTRY TRAJECTORIES
Jason L. Speyer and Edward Womble Jul. 1971 28 p refs
(Contract NAS9-10268)
(NASA-CR-115145; E-2594) Avail: NTIS CSCL 22C

Approximate solutions are found for a reentry glider in closed form for the problem of maximizing a function of the terminal velocity, altitude, flight path angle, and heading angle subject to, at most, three terminal nonlinear constraints. The second order approximation of entry dynamics is used instead of the first order approximation. This approximation is found to compare favorably with an exact numerical optimal path. A three dimensional optimization problem is solved which includes second order approximation where the roll angle as well as the lift coefficient are determined subject to constraints which include the terminal heading angle. Author

N71-36159*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
TRACKING AND DATA SYSTEM SUPPORT FOR THE MARINER MARS 1969 MISSION. VOLUME 3: EXTENDED OPERATIONS MISSION
N. A. Renzetti, N. A. Linnes, and T. M. Taylor 15 Sep. 1971 114 p refs 2 Vol.
(Contract NAS7-100)
(NASA-CR-122068; JPL-TM-33-474-Vol-3) Avail: NTIS CSCL 22C

The tracking, telemetry, and command operations of the Deep Space Network with performance evaluations are presented. The use of the experimental ranging system, the tricome feed structure, and the experimental 400-kW transmitter at Deep Space Station 14 (Goldstone, California) are detailed. Author

N71-36160*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
FLIGHT PATH AND MISSION STRATEGIES TO SATISFY OUTER PLANET QUARANTINE CONSTRAINTS
Charles Gonzalez and William Stavro Aug. 1971 12 p ref Presented at the AAS/AIAA Astrodyn. Specialists Conf., Ft. Lauderdale, Fla., 17-19 Aug. 1971
(Contract NAS7-100)
(NASA-CR-121804; AAS-71-319) Avail: NTIS CSCL 22A

The quantitative results of an investigation of the effect of a planetary quarantine constraint on a typical 1977 Jupiter-Saturn-Pluto mission are presented. Optimum biasing strategies are investigated and fuel loading penalties are determined. Navigation characteristics of multiple outer planet missions where planetary quarantine constraints are imposed are described. The results indicate that two aim-point biases are required: an injection aim-point bias, requiring approximately 20 meters/second change in velocity to remove; and a final Jupiter aim-point bias, requiring approximately 10 meters/second to remove. Author

N71-36161*# Sandia Labs., Albuquerque, N. Mex. Planetary Quarantine Dept.
PLANETARY QUARANTINE PROGRAM Quarterly Report, period ending 31 Mar. 1971
Mar. 1971 75 p refs
(NASA Order W-12853)
(NASA-CR-121921; QR-20) Avail: NTIS CSCL 22A

Data covering relative humidity sensitivity of thermoradiation at 95 C, inactivation of naturally occuring spores in soil (PHS Phoenix stock), and the effect of extremely high radiation dose rates on Bacillus subtilis var. niger are reported. Results are given in tables and graphs. E.H.W.

N71-36162# Royal Observatory, Edinburgh (Scotland).
MULTICOLOUR PHOTOMETRY OF THE STARS IN NGC 2264
K. Nandy 1971 20 p refs *Its* Publications, Vol. 7, No. 4
Avail: NTIS

The photometry of the stars of NGC 2264 has been extended from UBV to R and I by photographic methods in order to study the infrared and ultraviolet excesses of the contracting members of the cluster. It has been shown that UBVRI photometry is an important tool in the seperating of T Tauri-like stars from reddened background stars. The importance of (V-R) color for estimating the spectral type of these stars is discussed. Author

N71-36163# Argonne National Lab., Ill.
AERODYNAMIC CHARACTERISTICS OF ATMOSPHERIC BOUNDARY LAYERS
Erich J. Plate 1971 190 p refs Sponsored by AEC
(TID-25485) Avail: NTIS

The reference case for all investigations of the structure of the atmospheric boundary layer is the neutrally stratified wind over uniform terrain. The effect of temperature on the wind profile, or the change in profile due to nonuniform terrain, is measured in terms of the deviation that is caused by the actual profile from this reference condition. It has recently been recognized that the planetary boundary layer consists of two

layers, each of which is governed by a different set of flow parameters. This flow structure is quite similar to that in the turbulent boundary layer along a flat plate. The lower layer is very closely analogous to that found in the aerodynamic boundary layer, in both cases resulting in a profile shape that is logarithmic. This analog is essential for representing the boundary layer of the atmosphere by the boundary layer along a flat plate in a wind tunnel, and a demonstration of the analogy yields a post facto validation of wind-tunnel modeling of mean velocity profiles for purposes of determining wind loads on structures and similar problems. Author

N71-36164# Universidad Nacional de Colombia, Bogota. Observatorio Astronomico Nacional.
OBSERVATORIO ASTRONOMICO NACIONAL ANNUAL 1971 [ANUARIO DEL OBSERVATORIO ASTRONOMICO NACIONAL 1971]
1971 112 p In SPANISH
Avail: NTIS

The 1971 almanac is presented. Tables presented include the ephemerides for the sun, moon, and planets. The right ascension and declination of the navigational stars are given for 1971 and 1972. Time conversion tables are also included.
Transl. by F.O.S.

N71-36165# Radio and Space Research Station, Slough (England).
CATALOGUE OF ROCKET AND SATELLITE DATA IN WORLD DATA CENTRE C
1971 30 p *Its* Issue No. 1
Avail: NTIS

Rocket and satellite launching data are catalogued in chronological order for the period from January through July 1971. Satellite sightings are also tabulated. F.O.S.

N71-36166*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif. Office of Advanced Research and Technology.
PRELIMINARY ANALYSIS OF AN ATMOSPHERE-ENTRY PROBE MISSION TO JUPITER
Byron L. Swenson, Larry E. Edsinger, Larry A. Manning, Susan M. Norman, Kenneth F. Sinclair et al Washington Sep. 1971 73 p refs
(NASA-TM-X-2338; A-3828) Avail: NTIS CSCL 22A

The preliminary feasibility of depositing an atmospheric-entry probe from a flyby mission to Jupiter has been examined. The scientific, operational, and system requirements and options for the entry mission are examined. In addition, technological problem areas are indicated. Author

N71-36167# European Organization for Nuclear Research, Geneva (Switzerland).
PHYSICS AND ASTROPHYSICS
E. Schatzman 16 Dec. 1970 110 p refs
(CERN-70-31) Avail: AEC Depository Libraries

Lectures are presented on thermodynamics; nonequilibrium; structure and evolution of stars; pulsation, rotation, abundance of the elements, and nucleosynthesis in stars; galaxies and the universe; and cosmology, gamma rays, strange objects, and abundance of the elements. NSA

N71-36168# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Flugmechanik.
CONTRIBUTIONS TO REENTRY MECHANICS OF SPACE VEHICLES [BEITRAEGE ZUR MECHANIK DES WIEDER-EINTRITTS VON RAUMFLUGKOERPERN IN DIE ATMOSPHAERE]
Ernst August Bockemueller (Ph.D. Thesis - Brunswick Univ.) Mar. 1971 130 p refs In GERMAN; ENGLISH summary
(DLR-FB-71-16) Avail: NTIS; ZLDI Munich: 22 DM

Based on the motion model of a masspoint in a Newtonian central force field under the influence of coplanar acceleration, the reentry mechanics of space vehicles are represented. Starting from the basic equations for the variation of total energy and angular momentum, relations are derived, which in important cases lead to analytical solutions which are partly refined.
Author (ESRO)

N71-36169# Institut d'Aeronomie Spatiale de Belgique, Brussels.
FROM YESTERDAY'S AERONOMY TO TOMORROW'S SPACE EXPERIMENT [DE L'AERONOMIE D'HIER A L'EXPERIENCE SPATIALE DE DEMAIN]
M. Nicolet 1970 130 p refs In FRENCH *Its* Aerononica Acta A No. 80-1970
Avail: NTIS

A survey is presented on aeronomy history involving the homosphere, heterosphere, and exosphere. Some consideration is given to planetary atmosphere with emphasis on Martian and Venusian atmospheres. ESRO

N71-36170# European Southern Observatory, Hamburg (West Germany).
EUROPEAN SOUTHERN OBSERVATORY BULLETIN NO. 8
Jun. 1971 39 p refs Partly in ENGLISH and partly in FRENCH
Avail: NTIS

CONTENTS:

1. METEOROLOGICAL OBSERVATIONS ON LA SILLA IN 1969 B. E. Westerlund p 5-20 (See N71-36171 22-20)
2. FLEXURE OF THE 3.60 M MIRROR AT THE EUROPEAN SOUTHERN OBSERVATORY G. Lemaitre (Obs. de Marseille France) p 21-31 refs (See N71-36172 22-14)
3. OBSERVING PROGRAMS FOR EARLY-TYPE STARS WITH EXTENDED ATMOSPHERES A. B. Underhill (Sterrewacht Sonnenborgh, Utrecht, Netherlands) p 33-38 (See N71-36173 22-30)

N71-36171# European Southern Observatory, Santiago (Chile).
METEOROLOGICAL OBSERVATIONS ON LA SILLA IN 1969 c20
B. E. Westerlund *In its* European Southern Obs. Bull. No. 8 Jun. 1971 p 5-20 (See N71-36170 22-30)
Avail: NTIS

Tables are given of the values of the following meteorological parameters: cloud cover, wind velocity, wind direction, temperature, and humidity. The observations were carried out at the La Silla Observatory in Chile during 1969.
ESRO

N71-36172# Observatoire de Marseille (France).
FLEXURE OF THE 3.60 m MIRROR AT THE EUROPEAN SOUTHERN OBSERVATORY [SUR LA FLEXION DU GRAND MIRROR DE 3,60 M DE EUROPEAN SOUTHERN OBSERVATORY] c14
G. Lemaitre *In* European Southern Obs. European Southern Obs. Bull. No. 8 Jun. 1971 p 21-31 refs In FRENCH (See N71-36170 22-30)
Avail: NTIS

The elastic deformation of the 3.60 m large mirror of La Silla Observatory telescope is studied, noting the load distribution on a static support system. ESRO

N71-36173# Sterrewacht Sonnenborgh, Utrecht (Netherlands).
OBSERVING PROGRAMS FOR EARLY TYPE STARS WITH EXTENDED ATMOSPHERES
Anne B. Underhill *In* European Southern Obs. European Southern Obs. Bull. No. 8 Jun. 1971 p 33-38 Presented at ESO Colloq., Nice, 1969 (See N71-36170 22-30)
Avail: NTIS

Profitable and interesting observing programs are discussed for early-type stars with extended atmospheres. These stars include shell stars, Wolf-Rayet stars, supergiants of types A2 to O9, and some main sequence stars. The purpose of the programs is to obtain information about the evolution of the stars and the rate at which observable changes in stellar spectra occur. ESRO

N71-36174*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
TRACKING AND DATA SYSTEM SUPPORT FOR THE MARINER MARS 1969 MISSION. VOLUME 2: MID-COURSE MANEUVER THROUGH END OF NOMINAL MISSION
N. A. Renzetti, K. W. Linnes, D. L. Gordon, and T. M. Taylor 1 Sep. 1971 151 p refs
(Contract NAS7-100)
(NASA-CR-122008; JPL-TM-33-474-Vol-2) Avail: NTIS CSCL 22C

The project requirements for tracking, telemetry, command, simulation, mission control, and compatibility testing were reviewed for matching to Deep Space Network (DSN) capabilities. The DSN capabilities to support the project were set forth in an operations plan describing the design of the DSN Systems formulated for the support of this particular project. Each of the systems is described. Unusual new features were the multi-mission telemetry system, which eliminated need for mission-dependent equipment at the tracking stations, and an experimental high-rate telemetry system operating at 16,200 bits/s. This unusually high rate permitted return of low-resolution pictures in real time and full-resolution pictures played back from the spacecraft tape recorder in less than 3 hr. The 26-m antenna stations of the deep space network provided the deep space phase support throughout the mission. During the cruise portion of the deep space phase, the DSN 64-m antenna at Goldstone, Calif., provided ranging data to planetary distances; during the planetary encounter, it provided the 16,200 bits/s capability by means of the block-coded, high-rate telemetry system. Author

N71-36175*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
LOST CITY METEORITE: ITS RECOVERY AND A COMPARISON WITH OTHER FIREBALLS
Richard E. McCrosky, Annette G. Posen, Gunther Schwartz, and Cheng-Yuan Shao 20 Aug. 1971 48 p refs Submitted for publication
(Grant NGR-00-015-004)
(NASA-CR-121931; SAO-Special-Rept-336) Avail: NTIS CSCL 03B

The meteorite was photographed in flight and recovered. Four fragments totaling 17 kg were found. Photometric and trajectory data for the Lost City meteor and another with similar flight characteristics are used to establish a preliminary calibration of the mass scale of other fireballs. There is excellent agreement between the photometric masses derived from the determination of the luminous efficiency of the meteoric process and the dynamic masses determined from the trajectory and the shape of the recovered meteorite. An analysis of a third meteor is presented. This meteor, 100 times the intensity of the Lost City meteor, reached maximum light and then was extinguished nearly instantaneously. The orbits of these meteors are similar to those of most other fireballs. Author

N71-36176# Astronomisches Inst., Bonn (West Germany).
ORIENTATION ANGLES OF GALAXIES AND COSMOLOGICAL PRIMEVAL MAGNETIC FIELD [ORIENTIERUNGSWINKEL VON GALAXIEN UND KOSMOLOGISCHES URMAGNETFELD]
Michael Reinhardt Ferd. Duemmlers Verlag 1970 59 p refs In GERMAN; ENGLISH summary
(Rept-80) Avail: NTIS

The distribution of the orientation angles of the apparent major axes of spiral galaxies in different areas of the sky are discussed and a graphical statistical test is applied. The deviations from randomness are found to be real. It seems difficult to ascribe them to selection effects. It is assumed that the angular momenta of galaxies originated rather late, at an age of the universe of some 10 to the 8th power when the protogalactic clouds had their maximum extension. It is further assumed that objects of the size of a supercluster of galaxies and their angular momenta were generated at the same time as the small objects of the size of globular clusters, well before the galaxies condensed, and that the angular momenta of the protogalactic clouds within a supercluster were preferentially oriented in the direction of the angular momentum of the supercluster. Furthermore it is assumed that the protogalaxies and the intergalactic matter were heated when most of the angular momentum was already transferred to the protogalaxies and these were just beginning to condense into galaxies. In addition it is assumed that there exists a primeval magnetic field, which was least at the time of the heating homogeneous on a scale of a supercluster. Author

N71-36177# Astronomisches Inst., Bonn (West Germany).
ON THE IONIZATION OF EMISSION LINE REGIONS IN SEYFERT AND N-TYPE GALAXIES AND IN QUASARS [ZUR IONISATION DER LINIENEMISSIONSGEBIETE IN SEYFERT- UND N-TYP GALAXIEN UND IN QUASAREN]
Michael Grewing Ferd. Duemmlers Verlag 1970 39 p refs In GERMAN; ENGLISH summary
(Rept-81) Avail: NTIS

Recent observations have shown that the optical continuum emission of Seyfert- and N-type galaxies is partly nonthermal in origin, most probably due to synchrotron component. The optical continuum emission of quasi-stellar objects might even be entirely nonthermal in origin. In view of these observations it seemed worthwhile to perform ionization- and thermal equilibrium calculations for a nonthermally heated gas. In these calculations photo- and collisional-ionization and radiative as well as dielectronic recombination was taken into account. The balance equations were solved numerically in an iterative manner, starting with an estimated electron temperature and density which are then continuously modified until a self-consistent solution is found. Results obtained for six nonthermal energy distributions are displayed. To compare with observations theoretical line strengths have been calculated under simplifying assumptions for a total of 26 emission line. These line strengths are compared to those found in Seyfert- and N-type galaxies as well as in quasi-stellar objects. The preliminary comparison shows that the electron temperatures estimated from the relative abundance of different ions agrees fairly well with independent temperature estimates from line ratios. Author

N71-36178*+ Massachusetts Inst. of Tech., Cambridge. Charles Stark Draper Lab.
OPTIMAL N-BURN MULTIORBIT INJECTION
Robert L. Singleton, Jr. (M.S. Thesis) Sep. 1971 91 p refs
(Contract NAS9-10388; DSR Proj. 55-41200)
(NASA-CR-115164; T-554) Avail: NTIS CSCL 22C

A theory is discussed which establishes ground rules for computing characteristic velocity losses over an optimally-steered, finite-thrust trajectory on the basis of the velocity impulse required for the same maneuver. Utilizing this theory, a procedure for computing gravity losses over an n-burn multiorbit escape trajectory of specified final energy is developed. A technique is presented which can be readily and efficiently employed to predict optimal burn schedules for time-open and time-fixed multiorbit escape maneuvers for high specific-impulse powerplants such as nuclear rockets. Author

N71-36179*+ National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
GUIDE TO LUNAR ORBITER PHOTOGRAPHS
Thomas P. Hansen Washington 1970 264 p
(NASA-SP-242) Avail: NTIS; SOD $7.00 CSCL 03B

Information is presented on the location and coverage of

each photograph returned by the Lunar Orbiter series of spacecraft. Small-scale maps show the overall coverage of each mission and the areas of common coverage among sites of different missions. Large-scale maps show coverage of the individual photographs at each target area. The characteristics of the cameras and of the various orbital sequences utilized are given for background information pertinent to an understanding of Lunar Orbiter photography. Author

N71-36180 Texas Univ., Austin.
THE GEGENSCHEIN
Robert George Roosen (Ph.D. Thesis) 1970 177 p
Avail: Univ. Microfilms Order No. 70-18083

The optical properties of the interplanetary medium in the direction of the Gegenschein were investigated in detail both theoretically and observationally. The characteristics which must be considered theoretically are: (1) the apparent phase function of the particles producing the Gegenschein; (2) the distribution of these particles with respect to distance from the earth and the sun; and (3) the effect of the earth's shadow on the illumination of these particles. All previous explanations for the Gegenschein found in the literature were considered; the only one found tenable is that the Gegenschein is caused by light reflected from particles of dust in heliocentric orbits. Precise photometric measurements in the antisolar direction have also yielded observational evidence of possible inhomogeneities in the zodiacal cloud. These inhomogeneities may be due to debris from comet Encke. Dissert. Abstr.

N71-36181 New York Univ., N.Y.
THE STRUCTURE AND CIRCULATION OF THE LOWER ATMOSPHERE OF VENUS
John Matthew Diamante (Ph.D. Thesis) 1969 317 p
Avail: Univ. Microfilms Order No. 70-19280

An expression has been obtained for the microwave absorption coefficient in a planetary atmosphere composed principally of carbon dioxide, with some nitrogen and trace amounts of water vapor. This expression has been applied to a model of the atmosphere of Venus derived from the measurements of the Mariner 5 and Venera 4 spacecraft to determine the microwave brightness temperature and radar attenuation as functions of frequency. The results indicate that the final Venera 4 measurements at a distance of 6079 km from the planetary center do not represent the average conditions near the surface of Venus. A numerical model of the general circulation of the lower atmosphere of Venus has been developed. Models with heating near the top or at the bottom of the atmosphere have been studied. The horizontal winds average from one to ten m/sec for all the models. If most of the heating takes place in the higher atmospheric layers, the model predicts a relatively gentle general circulation, with winds on the order of 1 m/sec, which may permit topographical decoupling of the circulation in the lower atmosphere. This suggests the possibility of substantially subadiabatic or even isothermal temperature lapse rates in these regions. Dissert. Abstr.

N71-36182 California Univ., Berkeley.
A SCANNER ABUNDANCE STUDY OF LATE G AND K DWARFS
Benjamin Joseph Taylor (Ph. D. Thesis) 1969 187 p
Avail: Univ. Microfilms Order No. 70-17668

A technique for obtaining metal abundances of late-type stars is applied to field dwarfs in the solar vicinity and the Hyades. The following major conclusions are reached: (1) super-metal-rich dwarfs are to be found in the solar neighborhood, (2) the tight correlation between N, Na, and Fe abundances for evolved stars exists for dwarfs as well, (3) dwarfs for which e is greater than 0.35 and/or the absolute value of W is greater than 40 km/sec and which have solar or higher metallicities exist, (4) the abundance heterogeneity in the Hyades moving group probably exists in the 61 Cyg group as well, and (5) helium abundances ranging from fractions of 0 to 0.5 by weight may well be found among some stars in the solar neighborhood. Dissert. Abstr.

N71-36183 State Univ. of New York At Buffalo.
CONVECTIVE INSTABILITY IN AN ATMOSPHERE WITH ELECTROMAGNETIC EFFECTS
Kin-Wai Yeung (Ph.D. Thesis) 1969 104 p
Avail: Univ. Microfilms Order No. 70-17375

The onset of convection induced by gravity in a horizontal, infinite, polytropic fluid layer in the presence of a uniform, vertical magnetic field is considered. The dissipative processes arising from viscosity, thermal and electrical conductivities are taken into account. It is found that the magnetic field has an inhibitive effect upon instability, but this effect decreases with increasing layer thickness. The convective instability induced by both the electrostrictive force and the gravitational force is also investigated. Two special cases are considered. The first considers the gravitational force to vanish so that only the electrostrictive force exists. The second considers the simultaneous effect of the gravitational and the electrostrictive forces. It is found that the applied electric field has a destabilizing effect. The results can be applied to sunspot phenomena, and to interpreting the outburst of the terrestrial windstorm. Dissert. Abstr.

N71-36184 Yale Univ., New Haven, Conn.
THE POSSIBILITY OF CAPTURE IN THE RESTRICTED AND IN THE GENERAL PROBLEM OF THREE BODIES
Chao-Ho Sung (Ph.D. Thesis) 1969 103 p
Avail: Univ. Microfilms Order No. 70-19520

It is shown that in the general problem of three bodies, capture occurs only in a system with positive total energy when a hyperbolic motion becomes a hyperbolic-elliptic motion. The astronomical application to the stability of the captured comets is discussed and it is indicated that unless nongravitational forces are in effect, a comet can not be captured permanently by Jupiter or other planets. An attempt is made to present a complete review of the literature of capture with emphasis on Soviet contributions. Hopf's extended theorems of Poincare's recurrence theorem are also discussed. These are the main theorems applied in the consideration of the question of the possibility of capture. Dissert Abstr.

N71-36185# Purdue Univ., Lafayette, Ind.
OPTIMAL CONTROL OF SPACECRAFT RENDEZVOUS
Thomas Kong Wu (Ph.D. Thesis) 1970 135 p
Avail: Univ. Microfilms Order No. 70-18777

A coplanar orbit rendezvous problem was solved. The guidance law used for rendezvous is that of state feedback guidance. The gains of state feedback were constrained to be constant. The rendezvous was solved for near circular orbit as well as elliptical orbit. Two cases were considered: (1) one for unbounded control and (2) the other for bounded control. The technique used to obtain the optimum gains is the gradient method. The results with constant gain were compared to unconstrained time varying optimum gain by Kalman's formulation. They indicate that the constant gain constraint increases the fuel consumption by 5-15%. The proposed guidance scheme has also been investigated for its sensitivity with respect to the rendezvous period as well as perturbation in the state variable parameters. The results indicate that the gains are independent of the initial value of the state vector and very insensitive to the state vector parameter changes. The rendezvous period must be about 1/3 of orbit period in order to achieve maximum fuel economy. The simulations of the proposed guidance scheme demonstrated smooth rendezvous and simplicity of implementation. Dissert. Abstr.

N71-36215# Finnish Academy of Technical Sciences, Helsinki.
STELLAR TRIANGULATION IN FINLAND
T. J. Kukkamaki *In* Polish Acad. of Sci. Observations of Artificial Earth Satellites, no. 9, 1969 1970 p 95-96 (See N71-36206 22-31)
Avail: NTIS

31 SPACE VEHICLES

Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see 30 Space Sciences. For related information see also 28 Propulsion Systems; and 32 Structural Mechanics.

N71-36186*# North Carolina State Univ., Raleigh. Dept. of Mechanical and Aerospace Engineering.
CALCULATION OF INVISCID SURFACE STREAMLINES AND HEAT TRANSFER ON SHUTTLE TYPE CONFIGURATIONS. PART 1: DESCRIPTION OF BASIC METHOD
Fred R. De Jarnette Aug. 1971 81 p refs
(Contract NAS1-10277)
(NASA-CR-111921) Avail: NTIS CSCL 22B

A computer program is developed which calculates laminar, transitional, and turbulent heating rates on arbitrary blunt-nosed three-dimensional bodies at an angle of attack in hypersonic flows. The geometry of the body is generated from a two-dimensional cubic spline fit to coordinates at several axial stations along the body. Inviscid surface streamlines are calculated optionally from input pressure distributions or modified Newtonian pressures. Laminar and turbulent heating rates are determined along a streamline from the application of the axisymmetric analogue, or small cross flow assumption. The transition region is specified optionally by geometric location, momentum thickness Reynolds number, or integrated unit Reynolds number along a streamline. Transition heating rates are then calculated as a weighted average of the local laminar and turbulent values. Either perfect gas or equilibrium air properties may be specified. Results are presented for a blunted 15 deg half-angle cone, a blunted 70 deg delta wing, and the HL-10 lifting body. By comparison with experimental data for the blunted cone the method was found to yield reasonably accurate laminar heating rates for this case. Author

N71-36187*# Michigan Univ., Ann Arbor. Dept. of Aerospace Engineering.
TABLES OF ELECTROSTATIC STRUCTURE OF NEAR WAKES BEHIND SPACE PROBES AT THE MESOTHERMAL SPEEDS
H. Jew and V. C. Liu 1971 136 p refs
(Grant NGR-23-005-094)
(NASA-CR-121963; SR-2) Avail: NTIS CSCL 22C

Tables of electron density, ion density, net charge density, and potential in the sphere wake and cylinder wake are presented. These tables contain the whole set of near wake points as originally computed, and are presented in order that they be available to research workers who may have need of these more precise results. A.L.

N71-36188*# Scientific Translation Service, Santa Barbara, Calif.
FLIGHT OF SOYUZ 10 [POLET SOYUZA 10]
Washington NASA Sep. 1971 5 p Transl. into ENGLISH from Priroda (USSR), no. 6, 1971 p 2-3
(Contract NASw-2038)
(NASA-TT-F-13931) Avail: NTIS CSCL 22C

The launching of the Soyuz 10 spacecraft and its docking with the Salyut space station are described. The program of experiments and the Soyuz 10 return to earth are also included. Author

N71-36189*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md. Geodynamics Branch.
ANOMALOUS ACCELERATIONS OF THE PAGEOS SPACECRAFT
D. E. Smith and K. E. Kissel (Aerospace Research Labs., Wright-Patterson AFB Ohio) Aug. 1971 9 p refs Presented at COSPAR Conf., Seattle, Jun. 1971
(NASA-TM-X-65683; X-553-71-338) Avail: NTIS CSCL 22C

Observational studies of Pageos have indicated that the balloon satellite experiences very large periodic accelerations whenever the orbit intersects the earth's shadow. In 1969 the dynamical behavior of Pageos on its axis and the detailed shape of the balloon were determined from photometric observations by new methods. These studies showed that Pageos is not spherical but ellipsoidal with major and minor axes approximately 34 meters and 27 meters, respectively and rotating about a minor axis which is itself precessing. These results on the dynamical behavior of Pageos were used in a new theory of radiation pressure perturbations, that includes the effects of spacecraft attitude, rotational behavior and specular and diffuse reflection, and used to predict the acceleration of Pageos for 3 months in 1969. The predictions, based on the observed rotational motion, a specular reflectivity of 85% and a spacecraft mass of 55 kg, show that the new theory computes the observed anomalous accelerations of Pageos to about 0.00001 revolutions per day or better than 10%. This is believed to be one of the first demonstrations of coupling between the rotational motion of a spacecraft on its axis and the dynamics of its orbit. Author

N71-36190*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
STATUS OF HIGH POWER TECHNOLOGY FOR EDUCATIONAL SATELLITES
Perry W. Kuhns 1971 12 p Presented at Intern. Telemetry Conf., Washington, D. C., 27-29 Sep. 1971; Sponsored by Intern. Found. of Telemetering, Instr. Soc. of Am., and Electron. Ind. Assoc.
(NASA-TM-X-67933; E-6606) Avail: NTIS CSCL 22B

Based on a general survey, it is recommended that the present communication system for education expand outward and inward to the less advantaged. Through the use of satellites the system growth-trend can be different. As the educational systems are brought into operation, community reception can commence in widespread rural and remote areas. Through the use of information storage and retrieval, education can be available 24 hours, 7 days a week. Thus, the nation can be served by a system which will be established equally among all segments of the population. This high power communication system will require additional terminals, more interconnections, and more frequencies. E.M.C.

N71-36191*# General Dynamics/Convair, San Diego, Calif.
A PRELIMINARY INVESTIGATION OF POTENTIAL VALUE-LOADS ALLEVIATION CONTROL FOR SPACE SHUTTLE VEHICLES
Bernard J. Kuchta 30 Jun. 1971 120 p refs
(Contract NAS9-11191)
(NASA-CR-115165; GDC-DDE71-001) Avail: NTIS CSCL 22B

The study examined the application of rigid body load relief and modal suppression control systems. Efforts were also expended on a preliminary fatigue damage analysis. The study was conducted for a two-element, straight, fixed-wing configuration. To determine the performance penalties associated with a given load reduction technique, closed loop guidance was incorporated into load trajectory analysis. Orbiter and booster element wing and horizontal tail design conditions were ascent head/tail winds and entry maximum pullout normal acceleration. Minimum material gage influences the design for major portions of the orbiter horizontal tail and wing. Load relief is necessary for the ascent side wind condition to maintain control of the vehicle and to reduce vertical tail design loads. Load reduction can save approximately 3 percent of the orbiter and booster wing and horizontal tail structural weight. Load reduction can reduce the vertical tail load by 25 percent which results in a structural weight saving of 12 percent. Author

N71-36192*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
SPACE SHUTTLE TECHNOLOGY CONFERENCE. VOLUME 1: OPERATIONS, MAINTENANCE, AND SAFETY
3 May 1971 283 p refs Presented at the Space Shuttle Technol. Conf., Phoenix, Ariz., 16 Mar. 1971
(NASA-TM-X-67264; KSC-TR-1113-Vol-1) Avail: NTIS CSCL 22B

CONTENTS:

1. SPACE SHUTTLE OPERATIONS, MAINTENANCE AND TECHNOLOGY INTEGRATION C. C. Gay, Jr. (NASA, Wash., D. C.) p 1-12 (See N71-36193 22-31)

2. ANALYSIS OF APOLLO LAUNCH OPERATIONS EXPERIENCE J. J. Hart p 13-53 (See N71-36194 22-31)

3. AIRLINE VIEWPOINT OF SPACE SHUTTLE MAINTENANCE CONCEPTS N. Krull (Am. Airlines, Tulsa, Okla.) p 55-74 (See N71-36195 22-31)

4. ONBOARD VERSUS GROUND CHECKOUT OF FLUID MECHANICAL SYSTEMS L. A. Mavros, J. E. Harward, and R. H. Prickett (McDonnell-Douglas Astron. Co., St. Louis, Mo.) p 75-90 refs (See N71-36196 22-31)

5. LOGIC DEVICES FOR THE READINESS ASSESSMENT OF MECHANICAL COMPONENTS D. J. Hartung and C. R. Browning (GE, Daytona Beach, Fla.) p 91-107 (See N71-36197 22-31)

6. A STUDY OF TECHNIQUES FOR THE AUTOMATED VERIFICATION OF REDUNDANCY F. A. Ford, T. W. Hasslinger (Radiation, Inc., Melbourne, Fla.), and W. R. McMurran p 109-135 (See N71-36198 22-31)

7. SPACE SHUTTLE OPERATIONS ANALYSIS BY COMPUTER SIMULATIONS D. G. Satterfield (IBM, New York) p 137-156 (See N71-36199 22-31)

8. USING THE COMPUTER AS AN AID IN PLANNING OPERATIONAL ANALYSIS BY SIMULATION R. D. Smith p 157-173 (See N71-36200 22-31)

9. DYNAMICS AND CONTROL FOR ORBITAL RETRIEVAL OPERATIONS USING THE SPACE SHUTTLE M. H. Kaplan, W. H. Yerber, E. J. Creehan, and E. c. Thoms (Penns. State Univ., Univ. Park) p 175-201 refs (See N71-36201 22-31)

10. SPACE SHUTTLE CREW/COMPUTER COMMUNICATIONS B. Hodges (NASA, Marshall Space Flight Center) and D. Anderson (McDonnell-Douglas Astron. Co.) p 203-226 refs (See N71-36202 22-31)

11. HOW TO ASSURE SAFE MISSION TERMINATIONS H. Wolf and M. Vale (Grumman Aerospace Corp.) p 227-260 refs (See N71-36203 22-31)

12. A PROPOSED INCIPIENT FIRE AND TOXIC GAS CAUTION AND WARNING SYSTEM FOR SHUTTLE A. C. Krupnick (NASA, Marshall Space Flight Center) p 261-276 (See N71-36204 22-05)

13. FIRE PROTECTION DESIGN FOR SHUTTLE G. F. Ard p 277-284 (See N71-36205 22-05)

N71-36193*# National Aeronautics and Space Administration, Washington, D.C.
SPACE SHUTTLE OPERATIONS, MAINTENANCE AND TECHNOLOGY INTEGRATION
C. C. Gay, Jr. *In its* Space Shuttle Technol. Conf., Vol. 1 3 May 1971 p 1-12 (See N71-36192 22-31)
Avail: NTIS CSCL 22B

Development of the concept of an economical fully reusable space transportation system is discussed. Integration of technology requirements for facilities, operational support, logistics, crew and passenger mix, mission capabilities, maintenance and checkout operations, and abort and recovery operations is described. A.L.

N71-36194*# National Aeronautics and Space Administration, John F. Kennedy Space Center, Cocoa Beach, Fla.
ANALYSIS OF APOLLO LAUNCH OPERATIONS EXPERIENCE
James J. Hart *In its* Space Shuttle Technol. Conf., Vol. 1 3 May 1971 p 13-53 (See N71-36192 22-31)
Avail: NTIS CSCL 22D

Apollo launch operations experience was reviewed and analyzed in order to identify areas in which changes to operational procedures could be identified that would affect the space shuttle design concept and planned ground operations. Results are presented graphically of responses to a questionnaire covering the following subjects: (1) operational and test procedures; (2) comparison of airborne vs. ground procedures; (3) shuttle design considerations (4) frequency of testing of reusable equipment; (5) major time contributing factors in procedures; (6) cost saving changes; (7) ten most troublesome hardware problems for Apollo program; (8) processing schedules; (9) Apollo launch vehicle and CSM failure reports; (10) GSE modification manhours; and (11) anomalies resulting from human factors during tests on CSM and LM. A.L.

N71-36195*# American Airlines, Inc., Tulsa, Okla.
AIRLINE VIEWPOINT OF SPACE SHUTTLE MAINTENANCE CONCEPTS
Nicholas Krull *In* NASA. Kennedy Space Center Space Shuttle Technol. Conf., Vol. 1 3 May 1971 p 55-74 (See N71-36192 22-31)
Avail: NTIS CSCL 22D

Commercial airline maintenance concepts were reviewed and it was concluded that many of these concepts can be directly applied to the space shuttle program. Maintenance concepts considered directly applicable are: (1) use of computer programs to analyze and diagnose condition of aircraft and determine maintenance requirements; (2) use of inventory models to optimize spare allocations and minimize inventory levels; (3) use of techniques for developing ground support equipment and tooling requirements and procedures for turnaround maintenance; and (4) personnel selection and training concepts. A.L.

N71-36196*# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
ONBOARD VERSUS GROUND CHECKOUT OF FLUID MECHANICAL SYSTEMS
Louis A. Mavros, James E. Harward, and Richard H. Prickett *In* NASA. Kennedy Space Center Space Shuttle Technol. Conf., Vol. 1 3 May 1971 p 75-90 refs (See N71-36192 22-31)
Avail: NTIS CSCL 22D

The low cost and quick turnaround requirements of the space shuttle program suggest an investigation of the economics of automated checkout systems. The tradeoff of autonomous onboard checkout versus ground checkout of the space shuttle systems is discussed. Evaluation was made of the feasibility of automatic servicing, checkout, trend analysis, and fault isolation of fluid mechanical systems. Computer controlled checkout techniques including shuttle to GSE electrical interfaces were examined. New concepts of testing are discussed and compared to previous methods of automated checkout, the ultimate objective being an optimum space shuttle checkout philosophy.
Author

N71-36197*# General Electric Co., Daytona Beach, Fla.
LOGIC DEVICES FOR THE READINESS ASSESSMENT OF MECHANICAL COMPONENTS
D. J. Hartung and C. R. Browning *In* NASA. Kennedy Space Center Space Shuttle Technol. Conf., Vol. 1 3 May 1971 p 91-107 (See N71-36192 22-31)
Avail: NTIS CSCL 22D

Investigations directed toward definition of the logic device required for processing basic performance data originating at a mechanical line replaceable unit such as a pump, pneumatic regulator, valve, etc. were conducted. Sensor data resulting from state-of-the-art instrumentation techniques were examined in detail to determine logic device physical and functional configuration. Functional integration of this concept is consistent with advanced checkout philosophies. Three logic device implementation concepts were considered, and each was found to have application depending upon mechanical component

density, complexity, and/or similarity. Guidelines for application of each concept are discussed. Author

N71-36198*# Radiation, Inc., Melbourne, Fla.
A STUDY OF TECHNIQUES FOR THE AUTOMATED VERIFICATION OF REDUNDANCY
F. A. Ford and W. R. McMurran (NASA. Kennedy Space Center) *In* NASA. Kennedy Space Center Space Shuttle Technol. Conf., Vol. 1 3 May 1971 p 109-135 (See N71-36192 22-31)
(Contract NAS10-7072)
Avail: NTIS CSCL 22D

The problem of verifying the operation of equipments in redundant configurations was investigated. Briefly discussed are: (1) methodology for verification; (2) identification of unverifiable situations; (3) aids for justifying continuous verification; (4) design criteria; and (5) guidance for implementing verification. Author

N71-36199*# International Business Machines Corp., New York.
SPACE SHUTTLE OPERATIONS ANALYSIS BY COMPUTER SIMULATIONS
Don G. Satterfield *In* NASA. Kennedy Space Center Space Shuttle Technol. Conf., Vol. 1 3 May 1971 p 137-156 (See N71-36192 22-31)
Avail: NTIS CSCL 22C

Planning for the space shuttle launch operations will be an order of magnitude greater than that required in all previous launch programs. Optimization of fleet size, facilities and support equipment must be accomplished if cost effective goals of the program are to be met and, indeed, if program launch rates and schedules are to be maintained. The use of computer simulations provides an effective method to aid in the optimization of fleet size, facilities, and support equipment. It provides a useful tool to test the impact of new requirements as well as evaluate the risks associated with decisions. Author

N71-36200*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
USING THE COMPUTER AS AN AID IN PLANNING OPERATIONAL ANALYSIS BY SIMULATION
Raul D. Smith *In its* Space Shuttle Technol. Conf., Vol. 1 3 May 1971 p 157-173 (See N71-36192 22-31)
Avail: NTIS CSCL 22C

Investigations into the use of computers as aids in planning reveal that without graphic communications, where a picture is worth a thousand words, and a means of relating pictures to real life, and changing the pictures rapidly and economically to reflect real life, computers will have little real use in managerial planning and actual operations. With this capability, operational and planning personnel will have one of the most powerful tools they could possess. It allows a fast economical analysis of present problems, potential problems, and the avoidance of problems which need not be planned. It is emphasized, however, that: (1) a computer is no substitute for human reasoning and decision making. (2) a human is no substitute for computer caculations and repetitive operations. (3) use of a computer in planning requires caution since it can help define probabilities but not interpret them. Author

N71-36201*# Pennsylvania State Univ., University Park. Dept. of Aerospace Engineering.
DYNAMICS AND CONTROL FOR ORBITAL RETRIEVAL OPERATIONS USING THE SPACE SHUTTLE
Marshall H. Kaplan, William H. Yerber, Edward J. Creehan, and Edward C. Thoma *In* NASA. Kennedy Space Center Space Shuttle Technol. Conf., Vol. 1 3 May 1971 p 175-201 refs (See N71-36192 22-31)
(Grant NGR-39-009-162)
Avail: NTIS CSCL 22C

Dynamics and control problems associated with rendezvous and capture of an uncooperative object are reviewed. A general discussion of retrieval problems is offered, and problems peculiar to rescue from a tumbling space station are briefly outlined. Specific areas considered with respect to retrieval operations include the problem of despinning an arbitrarily spinning object of moderate size, automatic orbit control for maintaining a given parking position relative to an object, transfer trajectories of a despin package, and techniques for determining spin axis and rate of an uncooperative body. Author

N71-36202*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SPACE SHUTTLE CREW/COMPUTER COMMUNICATIONS
Bobby Hodges and Don Anderson (McDonnell-Douglas Astronautics Co.) *In its* Space Shuttle Technol. Conf., Vol. 1 3 May 1971 p 203-226 refs (See N71-36192 22-31)
Avail: NTIS CSCL 22B

The crew/computer communications functions and methods required for future space travel are described. Current results of the astronaut/computer communications study now in progress at MSFC are summarized. The starting point in this task was to draw upon the experience which has been gained in the space programs by evaluating existing and proposed methods of crew/computer interaction. This resulted in the characterization of specific criteria to form a study baseline establishing trends from which the degree of computer automation could be extrapolated. The function of each subsystem of the spacecraft was analyzed to determine the degree of manned and automatic control and their interrelationships. The ultimate method suggested for future onboard crew/computer communications is voice communications with self-educating computer systems. The methods described are not that exotic but are considered as intermediate solutions to the onboard crew/computer communications. Briefly, the crew/computer communication methods presented utilize remote graphic displays for entering data and a technology oriented vocabulary for describing tasks to the computer. Author

N71-36203*# Grumman Aerospace Corp., Bethpage, N.Y.
HOW TO ASSURE SAFE MISSION TERMINATIONS
Henry Wolf and M. Vela *In* NASA. Kennedy Space Center Space Shuttle Technol. Conf., Vol. 1 3 May 1971 p 227-260 refs (See N71-36192 22-31)
Avail: NTIS CSCL 22C

A study of Grumman's G3 design for a two-stage reusable booster and orbiter was conducted and results indicate: (1) situations do exist requiring escape provisions; (2) launch pad, landing, and ferry flight takeoff are escape critical regions; (3) sufficient warning of an imminent explosion is crucial to safe escape; (4) three manned compartments present no unique escape problems; (5) orbiter-flyaway-booster-escape-capsule concept seems to be a reasonable approach for development flights and nominal operations; and (6) ejection seats may be required for orbiter development flights. Author

N71-36204*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
A PROPOSED INCIPIENT FIRE AND TOXIC GAS CAUTION AND WARNING FOR SHUTTLE c06
A. C. Krupnick *In its* Space Shuttle Technol. Conf., Vol. 1 3 May 1971 p 261-276 (See N71-36192 22-31)
Avail: NTIS CSCL 06K

Based on present evidence, the gas filter cell offers the ultimate in background rejection. Not only does the gas filter cell offer sensitivity as good as the other systems, but its inherent throughput advantage offers more ultimate sensitivity at the expense of some source power. The most difficult problem in implementing the gas filter cell is making stable reference samples for the two-year lifetime. It is believed that the individual gas cell sensor can be made into a small, compact, and reliable instrument. However, multiple gas monitoring will probably require parallel optical systems. Based upon present data, the amount of toxic gas required to implement the system will be insufficient to be a significant hazard in the spacecraft.

Also, this approach is believed to offer the most convenient changes in gas of interest by simply adding a sensor for the new species without changing any of the existing system. Author

N71-36205*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
FIRE PROTECTION DESIGN FOR SHUTTLE c05
G. F. Ard *In its* Space Shuttle Technol. Conf., Vol. 1 3 May 1971 p 277-284 (See N71-36192 22-31)
Avail: NTIS CSCL 06K

The priority of the fire protection systems at KSC are reviewed along with the specific restrictions to the systems. The proposed fire protection measures and systems for the space shuttle as it moves through the vehicle assembly building launch pad, landing area, and safing area are described. A.L.

N71-36206# Polish Academy of Sciences, Warsaw.
OBSERVATIONS OF ARTIFICIAL EARTH SATELLITES, NO. 9, 1969
W. Dobaczewska and J. B. Zielinski 1970 392 p refs Mostly in RUSSIAN; partly in ENGLISH; partly in GERMAN
Avail: NTIS

Papers are presented on celestial and orbital mechanics, geodetic uses of satellite observations, satellite sounding of the upper atmosphere, and satellite instruments and methods of observations. For individual titles, see N71-36207 through N71-36245.

N71-36207# Academy of Sciences (USSR), Moscow.
HILL'S GRAVITATIONAL SPHERE AND THE STABILITY OF SATELLITE ORBITS
G. A. Chebotarev *In* Polish Acad. of Sci. Observations of Artificial Earth Satellites, no. 9, 1969 1970 p 5-7 In RUSSIAN; ENGLISH summary (See N71-36206 22-31)
Avail: NTIS

The movement of remote artificial satellites of the planets in the solar system is investigated by means of numerical integration. It is shown that the motion of direct satellites is unstable if the semimajor axis = 1/2 R, and the motion of retrograde ones is unstable if the semimajor axis = R, where R is the radius of hill's gravitational sphere. Author

N71-36208# Academy of Sciences (USSR), Moscow.
THEORY OF MOTION OF ARTIFICIAL EARTH SATELLITES, BASED ON A NON-KEPLERIAN INTERMEDIATE ORBIT
Ye. P. Aksenov *In* Polish Acad. of Sci. Observations of Artifical Earth Satellites, no. 9, 1969 1970 p 9-25 refs In RUSSIAN; ENGLISH summary (See N71-36206 22-31)
Avail: NTIS

On the basis of the two fixed centers problem the intermediate orbit is constructed, taking into account second, third, and partially fourth zonal harmonic of earth attraction. Intermediate orbit formulas are sufficiently compact and have no singularity for any of the initial conditions. Two forms of differential equations for intermediate orbit elements are derived, for finding perturbations of the satellites motion which were not taken into account in the construction of the intermediate orbit. The formulas for perturbations of elements caused by the totality of zonal earth harmonics are given. Formulas for the perturbations of elements, due to sectorial and tesseral harmonics of earth attraction, are obtained. The formulas for the sun-moon perturbations of intermediate orbit are given. The expressions for perturbations due to atmosphere resistance are obtained, taking into account the terms dependent on air resistance and earth unsphericity. Author

N71-36209# Bulgarian Academy of Science, Sofia.
SECULAR PERTURBATIONS IN THE MOTION OF ARTIFICIAL SATELLITES DUE ATMOSPHERIC ATTRACTION
V. G. Shkodrov and Ye. B. Shkodrova *In* Polish Acad. of Sci. Observations of Artificial Earth Satellites, no. 9, 1969 1970 p 27-33 refs In RUSSIAN; ENGLISH summary (See N71-36206 22-31)
Avail: NTIS

The atmospheric potential is expanded in spherical functions series up to fourth order. The average values of the coefficients of the spherical harmonics are obtained for every month of 1958. It is shown that the coefficients of the spherical harmonics change according to the redistribution of the atmosphere's density. The effect caused by the redistribution of the atmosphere's density must be taken into consideration by the improvement of the accuracy of the coefficient determination. The calculations show also that the difference between the values of J2 obtained from gravimetric and satellite observations cannot be explained with attraction of the atmosphere. Author

N71-36210# Polish Academy of Sciences, Warsaw.
THE TOPOCENTRIC TRAJECTORY OF A SATELLITE MOVING IN A CIRCULAR ORBIT
Jan Benevski *In its* Observations of Artificial Earth Satellites, no. 9, 1969 1970 p 35-40 In RUSSIAN; ENGLISH summary (See N71-36206 22-31)
Avail: NTIS

The trigonometric equation of the topocentric trajectory is given. The correlation between topocentric coordinates and time, and different methods of trajectory calculation are presented. Author

N71-36211# Academy of Sciences (USSR), Moscow.
THE POSSIBILITY OF DERIVING CERTAIN SATELLITE ORBITAL ELEMENTS IN SHORT TIME INTERVALS ACCORDING TO BASAL AND ASYNCHRONOUS OBSERVATIONS
T. V. Kasimenko *In* Polish Acad. of Sci. Observations of Artificial Earth Satellites, no. 9, 1969 1970 p 41-48 refs In RUSSIAN; ENGLISH summary (See N71-36206 22-31)
Avail: NTIS

Calculations include the osculating orbital elements at a given moment and the geocentric satellite positions at the time of observation. A method of improving the differential equations for the orbital elements is given. The right angle geocentric satellite coordinates are used to obtain the free terms of the conditional equations. Transl. by K.P.D.

N71-36212# Polish Academy of Sciences, Warsaw.
STABILITY REGIONS OF SATELLITE MOTION
K. Ziolkovski *In its* Observations of Artificial Earth Satellites, no. 9, 1969 1970 p 49-53 refs In RUSSIAN; ENGLISH summary (See N71-36206 22-31)
Avail: NTIS

The direct motion of the mass point around one of the primaries in the plane circular restricted three body problem is investigated. The solutions of this problem are found by the cross section method for the different mass ratios. The numerical method to establish the stability of these solutions is based on the idea that the stability of periodic orbits may be studied by considering orbits near the periodic orbits with the same value of the Jacobian constant. The stability regions are given for the graph: mass ratio versus distance from the center. Author

N71-36213# Academy of Sciences (USSR), Moscow.
DETERMINATION OF THE DIFFERENCE BETWEEN QUASI-DRACONIC AND DRACONIC PERIODS OF REVOLUTION FOR ARTIFICIAL EARTH SATELLITES
N. P. Yerpylev *In* Polish Acad. of Sci. Observations of Artificial Earth Satellites, no. 9, 1969 1970 p 55-73 refs In RUSSIAN; ENGLISH summary (See N71-36206 22-31)
Avail: NTIS

Variations of the quasi-draconic period are studied relatively to the draconic orbital period of satellites. It is shown that quasi-draconic periods determined at the same time both on

ascending and descending passages may differ considerably. Schemes for computing differences between quasi-draconic and draconic periods are given. The differences for two methods are calculated to be 72.124 and 88.383 millionths of the draconic period. Author

N71-36214# Academy of Sciences (USSR), Moscow.
THE ACCURACY OF SYNCHRONOUS PLANE AS A BASIC ELEMENT OF SPACE TRIANGULATION
I. D. Zhongolovich *In* Polish Acad. of Sci. Observations of Artificial Earth Satellites, no. 9, 1969 1970 p 77-93 refs In RUSSIAN; ENGLISH summary (See N71-36206 22-31)
Avail: NTIS

Formulas are derived which determine the accuracy of the synchronous plane, depending upon the geometric position of an artificial satellite relative to the end points of the earth chord from which the synchronous observations are made. Besides the formulas known previously, a new general formula is obtained which is used in a detailed analysis for optimal conditions of determining the synchronous plane. Different limitations on observations are accounted for such as earth's sphericity, nonregular character of the refraction near the horizon, and absence of very low satellites. Author

N71-36215# Finnish Academy of Technical Sciences, Helsinki.
STELLAR TRIANGULATION IN FINLAND c30
T. J. Kukkamaki *In* Polish Acad. of Sci. Observations of Artificial Earth Satellites, no. 9, 1969 1970 p 95-96 (See N71-36206 22-31)
Avail: NTIS

The Finnish Geodesic Institute has begun stellar triangulation, using a network with a lateral dimension of 200-300 km and which covers the entire country. They use three Schmidt-Veisala telescopes with a focal length of 1031 mm and an aperture of 400 mm. Similar telescopes were used for observing the GEOS 2 satellite. The targets were electron bursts in balloons, which had been excited by radio. The average error in the determination of a star's position was + or - 0.8 sec.
Transl. by K.P.D.

N71-36216# Deutsche Akademie der Wissenschaften zu Berlin (East Germany).
DETERMINATION OF THE RIGA-SOFIA DIRECTION VECTOR FROM THE OBSERVATIONS OF THE ECHO 2 SATELLITE [ZUR BESTIMMUNG DES RICHTUNGSVEKTORS RIGA-SOFIA AUS BEOBACHTUNGEN DES SATELLITEN ECHO 2]
K. Arnold, Wl. Hristov (Bulg. Acad. of Sci.), J. Kletnieks (Acad. of Sci. (USSR), Moscow), N. Georgiev (Bulg. Acad. of Sci.), K. Lapueshka (Acad. of Sci. (USSR), Moscow) et al *In* Polish Acad. of Sci. Observations of Artificial Earth Satellites, no. 9, 1969 1970 p 97-100 In GERMAN; RUSSIAN and POLISH summary (See N71-36206 22-31)
Avail: NTIS

Twenty-two synchronous photographs were taken in the program for determining the Riga-Sofia azimuth. Two interceptions of the satellite track were chosen for three pairs of photographs. The six observations obtained were normalized. The average error in azimuth after this preliminary normalization was less than + or - 1 second. During final normalization, much more observational data will be used, so that a significantly better result may be expected. Transl. by K.P.D.

N71-36217# Bulgarian Academy of Science, Sofia.
DETERMINATION OF THE COORDINATES OF OBSERVATION STATIONS AND THE INCLINATION OF THE REFERENCE ELLIPSOID FROM ASYNCHRONOUS LASER AND PHOTOGRAPHIC OBSERVATIONS
V. G. Shkodrov *In* Polish Acad. of Sci. Observations of Artificial Earth Satellites, no. 9, 1969 1970 p 101-106 ref In RUSSIAN; ENGLISH summary (See N71-36206 22-31)
Avail: NTIS

A method for determining the coordinates of the observation stations and the inclination of the geodetic system is given. The observations of the different stations are asynchronous, and the photographic and laser observations are performed simultaneously at each station. General formulas are obtained assuming that the determination of time is accurate. Author

N71-36218# Bulgarian Academy of Science, Sofia.
TRANSFORMATION OF GEODETIC GEOGRAPHIC COORDINATES AND ELLIPSOID HEIGHTS, AND THE DETERMINATION OF ELLIPSOIDAL AZIMUTH AND LENGTH OF A GEODETIC LINE, BY MEANS OF SYNCHRONOUS SATELLITE OBSERVATIONS c13
N. Georgiyev and I. Tolomanov *In* Polish Acad. of Sci. Observations of Artificial Earth Satellites, no. 9, 1969 1970 p 107-119 refs In RUSSIAN; ENGLISH summary (See N71-36206 22-31)
Avail: NTIS

The geodetic geographic coordinates and the ellipsoid height of the first station are assumed to be known. A vector conditional equation with unknowns for each satellite position is obtained from the derived geometric dependence between the radius vectors to the satellite, using the lateral radii of the curve and the heights above the ellipsoid of the two participating observation stations. For these calculations it is sufficient to have a single measured distance and the equatorial topocentric coordinates of the satellite for the synchronous moment of a single satellite position. Formulas are deduced for the determination of the geodetic geographic coordinates and the height above the ellipsoid of the second station, by an adjustment using the least squares method. The formulas for estimating the accuracy of the calculated values are also derived.
Transl. by K.P.D.

N71-36219# Hungarian Academy of Sciences, Budapest.
APPLICATION OF TETRAHEDROMETRIC RELATIONS TO THE CALCULATION OF SPACE NETWORKS
I. Kader and F. Karshai *In* Polish Acad. of Sci. Observations of Artificial Earth Satellites, no. 9, 1969 1970 p 121-136 refs In RUSSIAN; GERMAN and POLISH summaries (See N71-36206 22-31)
Avail: NTIS

A method is presented for calculating synchronous planes in non-skew networks in space, using the principles of solid trigonometry in relation to tetrahedra. The parameters for determining tetrahedral forms are discussed, as well as applications of tetrahedral relations to space geodesy, and the formation of spatial networks from tetrahedral elements. Weights for direction normalization are calculated on the basis of synchronous photographic observations. Transl. by K.P.D.

N71-36220# Czechoslovak Academy of Sciences, Prague.
DIRECT DETERMINATION OF DIRECTION COSINES OF LINE CONNECTING TWO STATIONS FROM NONSIMULTANEOUS OBSERVATIONS OF THE ARTIFICIAL EARTH SATELLITES c21
J. Vondrak *In* Polish Acad. of Sci. Observations of Artificial Earth Satellites, no. 9, 1969 1970 p 137-143 (See N71-36206 22-31)
Avail: NTIS

Initial data consist of the individual (generally nonsimultaneous) positions of the satellite obtained from several pairs of plates. It is advisable to use pairs of plates which were taken at both stations quasi-simultaneously. The proposed method gives simultaneously the direction cosines and several parameters describing the rotation of the plane for every plate pair. The plane defined by Station 1-Satellite-Station 2 rotates around the line connecting both stations. The number of rotation parameters and the number of plate pairs are determined by the least squares method, and every satellite position, obtained directly from the plate, gives one observation equation. It is shown that in the interval not exceeding 1 minute, the rotation of the plane can be described by a second order polynomial of time. Author

N71-36221# Academy of Sciences (USSR), Moscow.
ACCURACY OF DETERMINING THE POSITION OF THE GEOS-B SATELLITE IN SPACE ACCORDING TO SYNCHRONOUS RIGA-UZHGOROD OBSERVATIONS c21
A. G. Kirichenko *In* Polish Acad. of Sci. Observations of Artificial Earth Satellites, no. 9, 1969 1970 p 145-149 refs In RUSSIAN; ENGLISH summary (See N71-36206 22-31)
Avail: NTIS

Cartesian and spherical coordinates of GEOS 2 and its errors calculated in the ellipsoid of Krasovski system are determined by using synchronous observations of the satellite. These are performed by camera AFU-75 on the stations Riga and Ujgorod. Topocentric coordinates of two stations are reduced to their corresponding times. Author

N71-36222# Polish Academy of Sciences, Warsaw.
APPLICATION OF THE LEAST SQUARES METHOD GENERALIZED TO A DEPENDENT OBSERVATION FOR SPACE TRIANGULATION COMPENSATION c21
V. Baran *In its* Observations of Artificial Earth Satellites, no. 9, 1969 1970 p 151-160 refs In RUSSIAN; ENGLISH summary (See N71-36206 22-31)
Avail: NTIS

The proposed method involves a simple solution to the equation for the matrix X of corrections to the adjusted net point. The matrix X is a function of the net points, the matrix of the coordinates of vectors perpendicular to the lines connecting points on the ground with the satellite, the matrix of partial derivatives of functions, the matrix formed from the elements and the weight matrix. The correlative matrix of vector X is found in terms of the coefficient of variation and an adjusted net point. Formulas for the coefficient of variation and for correcting observed quantities are derived. The adjustment of an elementary construction of space triangulation is used as an example, and the possibility of simplifying the calculations is demonstrated. Author

N71-36223# Hungarian Academy of Sciences, Budapest.
DEVELOPMENT OF A GEODETIC EARTH SATELLITE NETWORK [ENTWICKLUNG EINES SATELLITENGEODAETISCHEN WELTNETZES] c13
F. Halmos *In* Polish Acad. of Sci. Observations of Artificial Earth Satellites, no. 9, 1969 1970 p 161-179 refs In GERMAN; RUSSIAN and POLISH summaries (See N71-36206 22-31)
Avail: NTIS

Earth observations of satellites using the SECOR method in measuring distances by lasers were used, in addition to the bases determined from polygonal measurements for determining the scale of a single geodetic earth satellite network. The formation of a single quadrangle from earth and satellite geodetic measurements is desirable. The network is formable on the basis of satellite observations (synchronous and nonsynchronous measurements of direction and distance) and geodetic triangulation and trilateral measurements, height being a possible third dimension. In such projects as the calculation of astronomical sizes or astronomical measurements made by satellite observation, observatory data would have greater accuracy if a worldwide geodetic network were employed. In the correlation of ground and satellite observations, it is proposed that the observation points of satellite stations be considered the dominant points. Using both distance and direction measurements the accuracy of such studies can be analyzed.
Transl. by K.P.D.

N71-36224# Czechoslovak Academy of Sciences, Prague.
CONTROL OF THE GEODETIC AZIMUTH BETWEEN TWO DISTANT POINTS c13
Fr. Khovorka *In* Polish Acad. of Sci. Observations of Artificial Earth Satellites, no. 9, 1969 1970 p 181-189 In RUSSIAN; GERMAN and POLISH summaries (See N71-36206 22-31)
Avail: NTIS

A simple method is given for directly determining the azimuth between two distant ground points. The geodetic coordinates of the observation stations and the topocentric equatorial coordinates of synchronous observations by artificial earth satellites can be measured. Based on these data the correction for the geodetic azimuth of the line joining both stations may be directly determined. Such a method increases accuracy in time calculation (synchronization). Experimental results for azimuth calculation between two Czechoslovakian stations, made on the basis of 86 synchronous satellite positions on four pairs of photographs, show good internal accuracy.
Transl. by K.P.D.

N71-36225# Polish Academy of Sciences, Warsaw.
ECCENTRIC OBSERVATIONS OF SATELLITES
Ya. Krynski *In its* Observations of Artificial Earth Satellites, no. 9, 1969 1970 p 191-197 In RUSSIAN; ENGLISH summary (See N71-36206 22-31)
Avail: NTIS

Reducing topocentric satellite position data from the satellite tracking stations on any geodetic point makes it possible to increase the quantity of observations on the satellite triangulation point. Observations from the neighboring stations are reduced and simultaneous observations are compared. The general analysis of the method and the best conditions of reduction is described. For satellite tracking stations Poznan and Borowiec the maximum reduced quantities for different observation conditions are calculated. Author

N71-36226# Academia R. P. R., Bucharest.
DETERMINATION OF THE SPACE VECTOR USING OPTICAL AND LASER OBSERVATIONS OF ARTIFICIAL EARTH SATELLITES
A. Dineski and Yu. Lerintsi *In* Polish Acad. of Sci. Observations of Artificial Earth Satellites, no. 9, 1969 1970 p 199-208 refs In RUSSIAN; FRENCH and POLISH summaries (See N71-36206 22-31)
Avail: NTIS

A practical example is given for determining space vectors from the measurement of directions and distances, using a method of compensation in the space network. The method is used for the space direction of Organ Pass-Jupiter using a Baker-Nunn network having 10 pairs of simultaneous observations made by GEOS-1: six pairs of measured directions and four pairs of directions and distances measured by laser between the Organ Pass stations and the satellites. The space direction which passes through these two stations was obtained in equatorial coordinates with an accuracy of + or - 0.097 sec (time) and + or - 2.60 sec (angle), but the length of the chord between the stations was accurate within + or - 33.5 m. The difference in the chord lengths obtained in this study and from known station coordinates was 4.0 m. Transl. by K.P.D.

N71-36227# National Academy of Sciences-National Research Council, Washington, D.C.
RESULTS IN SATELLITE GEODESY c13
J. Rolff *In* Polish Acad. of Sci. Observations of Artificial Earth Satellites, no. 9, 1969 1970 p 209-214 refs (See N71-36206 22-31)
Avail: NTIS

Results in satellite geodesy are usually obtained by applying the least squares method. Internal accuracies presently obtained are much smaller than the external ones in some cases. Systematic errors are discussed in order to obtain improved results. Some examples are given. Author

N71-36228# Bulgarian Academy of Science, Sofia.
CERTAIN ASPECTS OF THE INFLUENCE OF SOLAR ACTIVITY ON ATMOSPHERIC DENSITY c29
M. Kalinkov *In* Polish Acad. of Sci. Observations of Artificial Earth Satellites, no. 9, 1969 1970 p 217-228 refs In RUSSIAN; ENGLISH summary (See N71-36206 22-31)
Avail: NTIS

Atmospheric densities from precisely reduced observations of satellites as realizations of stochastic processes are examined. Comparison with solar activity indices yields a series of correlation functions. The construction of correlation diagrams permits a study in detail of the correlation between solar activity and atmospheric density variations. A linear filter for extrapolation of atmospheric density variations is constructed.
Author

N71-36229# Academy of Sciences (USSR), Moscow.
THE CAUSE OF THE 14-DAY HEAT FLUCTUATIONS IN THE EARTH'S UPPER ATMOSPHERE: VARIATIONS IN SOFT SOLAR X RADIATION OF 40-100 A c29
V. Ye. Chertoprud *In* Polish Acad. of Sci. Observations of Artificial Earth Satellites, no. 9, 1969 1970 p 229-245 refs In RUSSIAN; ENGLISH summary (See N71-36206 22-31)
Avail: NTIS

An autocorrelative analysis of rapid (10-20 days scale) changes of the satellite Saturn-A5 (1964-4A) deceleration and soft solar X-rays in the period of the minimal activity is performed. The conclusion, from a previous analysis of satellite deceleration fluctuations and solar activity indices, that the variations of soft solar X-rays are the cause of the upper atmosphere fortnightly thermal fluctuations is confirmed. Author

N71-36230# Academy of Sciences (USSR), Moscow.
NUMERICAL RESULTS OF DENSITY VARIATIONS IN THE UPPER ATMOSPHERE, OBTAINED BY CORRELATION ANALYSIS c13
V. Ye. Chertoprud and M. Kalinkov (Bulg. Acad. of Sci.) *In* Polish Acad. of Sci. Observations of Artificial Earth Satellites, no. 9, 1969 1970 p 247-253 refs In RUSSIAN; ENGLISH summary (See N71-36206 22-31)
Avail: NTIS

Applications of correlation analysis to the study of fluctuations in atmospheric densities, based on precise observations of six satellites, are discussed. Solar activity indices and fluctuations in earth satellite orbit decay are correlated. Autocorrelation functions for these indices and correlation functions for the fluctuations were found and the characteristic time of thermal relaxation was determined. Transl. by K.P.D.

N71-36231# Bulgarian Academy of Science, Sofia.
TWENTY-FOUR HOUR TEMPERATURE VARIATIONS IN THE MIDDLE IONOSPHERE c13
K. B. Serafimov *In* Polish Acad. of Sci. Observations of Artificial Earth Satellites, no. 9, 1969 1970 p 255-261 refs In RUSSIAN; ENGLISH summary (See N71-36206 22-31)
Avail: NTIS

Temperature variations in the middle ionosphere (100-180 km) are proportional to the solar height and have a variable inertial delay. The coefficients of these variations are computed on the basis of rocket experiments and asymmetry in the daily variations in electron density in the E layer, the E-F region, and the F 1 layer. The diurnal temperature variations are shown for constant height. Transl. by K.P.D.

N71-36232# Academy of Science, Paris (France).
INVESTIGATION OF CHANGES IN ATMOSPHERIC DENSITY COMPARED WITH AN ATMOSPHERIC MODEL [DIE UNTERSUCHUNG DER GEGENUEBER DEN ATMOSPHAERENMODELLEN ABWEICHENDEN LUFTDICHTEWERTE] c13
F. Berlier, M. III (Hung. Acad. of Sci.), and P. Kohler *In* Polish Acad. of Sci. Observations of Artificial Earth Satellites, no. 9, 1969 1970 p 263-275 refs In GERMAN; RUSSIAN and POLISH summaries (See N71-36206 22-31)
Avail: NTIS

The analysis shows an unexplained constant minimum in atmospheric density. Anomalous minima appeared in a number of years between 1959 and 1968. They cannot generally be explained in relation to solar activity. Transl. by K.P.D.

N71-36233# Hungarian Academy of Sciences, Budapest.
THE PERLO ORBITAL PERIOD DETERMINATION PROGRAM
A. Horvath and E. Illes-Almar *In* Polish Acad. of Sci. Observations of Artificial Earth Satellites, no. 9, 1969 1970 p 277-283 refs (See N71-36206 22-31)
Avail: NTIS

A procedure is described for analyzing period variations of a satellite by means of a program written in ALGOL. It is used to determine celestial equator transit times on the basis of a series of observations. A least squares solution of second order polynomials is presented. A theoretical function in the vicinity of the equator and angular velocities are calculated. Author

N71-36234# Hungarian Academy of Sciences, Budapest.
INVESTIGATION OF CHANGES IN THE PERIODS OF EIGHT SATELLITES DURING MAY 1966, WITH THE AID OF THE PERLO PROGRAM
I. Almar, A. Khorvat, and Ye. Illesh-Almar *In* Polish Acad. of Sci. Observations of Artificial Earth Satellites, no. 9 1969 1970 p 285-300 refs In RUSSIAN; ENGLISH summary (See N71-36206 22-31)
Avail: NTIS

Visual observations from 44 stations were collected. The program determined variations in the quasi-draconic satellite period by several different methods. It is shown that visual observations of non-balloon satellites are suitable for the study of vertical atmospheric density distribution up to 700 km.
Transl. by K.P.D.

N71-36235# Hungarian Academy of Sciences, Budapest.
AGREEMENT OF TWO DIFFERENT METHODS OF CALCULATING PERIODS [VERGLEICH DER NACH ZWEI VERSCHIEDENEN METHODEN BERECHNETEN UMLAUFS-ZEITEN]
A. Horvath, M. III, E. Illes-Almar, and B. Velevs (Bulg. Acad. of Sci.) *In* Polish Acad. of Sci. Observations of Artificial Earth Satellites, no. 9 1969 1970 p 301-308 refs In GERMAN; RUSSIAN and POLISH summaries (See N71-36206 22-31)
Avail: NTIS

The quasi-draconic period of a satellite was determined from visual observations. The agreement of the calculated periods shows that they are not entirely unique and in many cases cannot be regarded as different. Transl. by K.P.D.

N71-36236# Deutsche Akademie der Wissenschaften zu Berlin (East Germany).
FIRST RESULTS OF A DETERMINATION OF QUASI-DRACONIC PERIODS WITH THE AID OF PHOTOGRAPHIC OBSERVATIONS [ERSTE ERGEBNISSE DER BESTIMMUNG QUASI-DRAKONITISCHER PERIODEN MIT HILFE FOTOGRAFISCHER BEOBACHTUNGEN]
D. Ruhnow *In* Polish Acad. of Sci. Observations of Artificial Earth Satellites, no. 9, 1969 1970 p 309-319 refs In GERMAN; RUSSIAN and POLISH summaries (See N71-36206 22-31)
Avail: NTIS

A method is described for determining quasi-draconic periods from photographic observations. The method was tested on observational data from the Echo 2 and Pegaos satellites in 1968. The results show that the method used has improved accuracy, compared with the visual method employed up to now, by a factor of 10. The interval during which the effects of a change in the period may be noted is about 2-3 days for slow satellites (0.1 deg/sec) and about 0.25 days for a fast satellite (1 deg/sec). Transl. by K.P.D.

N71-36237# Academy of Sciences (USSR), Moscow.
A METHOD OF PHOTOGRAPHING WEAK IMAGES OF ARTIFICIAL EARTH SATELLITES c14
A. M. Lozinskiy *In* Polish Acad. of Sci. Observations of Artificial Earth Satellites, no. 9, 1969 1970 p 323-325 In RUSSIAN;

ENGLISH summary (See N71-36206 22-31)
Avail: NTIS

When photographing weak satellite images, the reference stars are at a considerable distance from the satellite. This increases the errors in coordinate determination. Baker-Nunn and large satellite cameras make it possible to photograph the field of weak stars on the same satellite still, taking the field errors into account. The theoretical positions of the reference stars, the satellite, and six to eight stars in the field around them were measured. From the constants derived, the actual satellite positions are calculated. This method eliminates error arising from working with photographs of large areas of the heavens.
Transl. by K.P.D.

N71-36238# Academy of Sciences (USSR), Moscow.
NEW SOVIET CAMERAS FOR OBSERVING ARTIFICIAL EARTH SATELLITES c14
K. Lapushka *In* Polish Acad. of Sci. Observations of Artificial Earth Satellites, no. 9, 1969 1970 p 327-348 In RUSSIAN; ENGLISH summary (See N71-36206 22-31)
Avail: NTIS

A description is given of a universal semiautomatic camera of the AUF-75 type with a four-axis mounting. The camera is used for observations of active, passive, bright, and weak satellites. A second camera for photographing active artificial satellites is described. Preliminary calculation of a star's position from photographs taken with this camera have an error approximately equal to 1 sec.
Author

N71-36239# Czechoslovak Academy of Sciences, Prague.
CALCULATION OF PARAMETERS FOR THE OPERATION OF A ZEISS CAMERA c14
G. Karsky *In* Polish Acad. of Sci. Observations of Artifical Earth Satellites, no. 9, 1969 1970 p 349-354 refs In RUSSIAN; ENGLISH summary (See N71-36206 22-31)
Avail: NTIS

A method is described for parameter calculation in order to establish the axes 1, 2, and 4 of the camera for satellite observations. The method involves approximating the apparent trajectory of the satellite by a small circle arc. The formulas are presented for calculating approximate parameters, fitting least squares, and calculating rotation speed about axis 3. The speed was calculated by numerical differentiation and was punched on an 8-track tape. A description of the program developed for the Minsk 22 computer and program changes are given.
Author

N71-36240# Bulgarian Academy of Science, Sofia.
A NEW METHOD OF PHOTOMETRIC OBSERVATION OF ARTIFICIAL EARTH SATELLITES USING THE SPIN PROGRAM c14
R. Radkov *In* Polish Acad. of Sci. Observations of Artificial Earth Satellites, no. 9, 1969 1970 p 355-359 refs In RUSSIAN; ENGLISH summary (See N71-36206 22-31)
Avail: NTIS

The axes of potentiometers are turned with the light changes of the satellites. Each potentiometer transmits a signal to a multichannel recorder which records the data of all observations on the same band or photofilm. The time signals are also recorded. The period of the light change of the satellite is determined from the curves registered simultaneously by at least two observations.
Author

N71-36241# Hungarian Academy of Sciences, Budapest.
REFRACTION PROBLEMS AND WAVE PROPAGATION IN DOPPLER GEODETICAL MEASUREMENTS c13
C. Ferencz, I. Ferencz, and G. Tarcsai *In* Polish Acad. of Sci. Observations of Artificial Earth Satellites, no. 9, 1969 1970 p 361-374 refs (See N71-36206 22-31)
Avail: NTIS

Errors in the Doppler shift are described which arise from using two or three coherent frequencies for correcting ionospheric refraction. The Appleton-Hartree formula is analyzed critically. The first results of the general theory of wave propagation in inhomogeneous media are presented.
Author

N71-36242# Hungarian Academy of Sciences, Budapest.
RELATIVISTIC EFFECTS AND OPTIMALIZATION IN DOPPLER GEODETICAL MEASUREMENTS c13
G. Tarcsai and F. Horvath *In* Polish Acad. of Sci. Observations of Artificial Earth Satellites, no. 9, 1969 1970 p 375-383 refs (See N71-36206 22-31)
Avail: NTIS

Theoretical investigations concerning the Doppler equation and results of model computations are discussed. It is shown that the relativistic effects are not negligible but amount to several parts in 10 to the 10th power of the transmitter frequency. Based on model computations, the relation between the azimuth and elevation of satellite at closest approach and the accuracy of determining the coordinates is determined. The latter is then used in choosing the optimal inclination which is equally suitable for determining the individual coordinates.
Author

N71-36243# Polish Academy of Sciences, Warsaw.
SATELLITE OBSERVATION STATIONS IN HELWAN AND ABU SIMBEL
M. Khairi Ali (Acad. of Sci., UAR) and B. A. Figaro (Acad. of Sci. (USSR), Moscow) *In its* Observations of Artificial Earth Satellites, no. 9, 1969 1970 p 385-390 refs In RUSSIAN; ENGLISH summary (See N71-36206 22-31)
Avail: NTIS

Astrometric observations for space geodesy according to the international research programs of Soviet synchronous observations and French Eurafrica are described. Steps are being taken for developing this work in the UAR. A second station near the temple of Abu Simbel and a new school in Cairo for observers at African stations are being established. Astronomical conditions at Abu Simbel site (latitude plus 22 deg and excellent weather conditions) are very suitable for classical astrometry.
Author

N71-36244# Deutsche Akademie der Wissenschaften zu Berlin (East Germany).
PLOTTING PHOTOGRAPHIC SATELLITE TRANSITS BY THE LOSINSKY AND ILL METHODS FROM MEASUREMENTS MADE BY A SINGLE STATION [BETRACHTUNGEN UEBER AUSWERTUNGEN FOTOGRAFISCHER SATELLITENPASSAGEN MIT HILFE DER METHODEN LOSINSKY UND ILL AUS VERMESSUNGEN EINER STATION] c14
E. Penzel *In* Polish Acad. of Sci. Observations of Artificial Earth Satellites, no. 9, 1969 1970 p 391-396 In GERMAN; RUSSIAN and POLISH summaries (See N71-36206 22-31)
Avail: NTIS

An algorithm was developed for determining the photographic observations of the alpha and delta positions. This was programmed for the Odra 1204 computer at the Rodewisch station. Initial data were the coordinates of subsatellite points and the arguments of their latitude. The first trials with the Echo 2 satellite in June 1968 yielded the values of t sub 0,1 for the latitude argument and the average quasi-draconic periods. The results of the observations were in good agreement with values obtained by a second method.
Transl. by K.P.D.

N71-36245# Polish Academy of Sciences, Warsaw.
REPORT ON THE COLLABORATION OF THE ACADEMIES OF SCIENCES OF THE SOCIALISTIC COUNTRIES REFERRING TO THE PROBLEM: SCIENTIFIC STUDIES USING ARTIFICIAL EARTH SATELLITE OBSERVATIONS FOR GEODETIC AND GEOPHYSICAL PURPOSES, 1 NOVEMBER 1968 - 31 DECEMBER 1969
A. Masevich and S. Tatevyan *In its* Observations of Artificial Earth Satellites, no. 9, 1969 1970 p 397-409 refs In RUSSIAN (See N71-36206 22-31)

Avail: NTIS

An international conference was held in 1969. The Academies of Science of Bulgaria, Hungary, East Germany, Cuba, Mongolia, Poland, Rumania, the Soviet Union, and Czechoslovakia took part. The problems discussed included visual observations of satellites for ephemeride application, upper atmosphere research using visual and photographic satellite observations, satellite geodesy, and the improvement of the equipment for satellite observations. Transl. by K.P.D.

N71-36246*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

STATIC AERODYNAMIC CHARACTERISTICS OF A SCOUT FIN WITH AN ENLARGED TIP CONTROL AT MACH NUMBERS FROM 0.40 TO 4.63

Robert J. Keynton and Thomas G. Muir (LTV Aerospace Corp.) Sep. 1971 53 p refs

(NASA-TN-D-6397) Avail: NTIS CSCL 22B

Results are presented of an experimental investigation to determine the static longitudinal aerodynamic characteristics of a fin with an enlarged tip control and the hingemoment coefficients of the enlarged tip control. The model was tested at angles of attack from -6 deg to 6 deg and fin tip control deflections from -20 deg to 20 deg. A 1/8-scale model of the -2 Scout first stage, with a tangent ogive nose, was used for these tests. Basic data obtained include the pitching-moment, rolling-moment, and normal-force coefficients of the fin and the hinge-moment coefficient of the enlarged tip control. Author

N71-36247*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

INVESTIGATION OF TECHNIQUE FOR CONDUCTING LANDING-IMPACT TESTS AT SIMULATED PLANETARY GRAVITY

Sandy M. Stubbs Sep. 1971 36 p refs

(NASA-TN-D-6459; L-7828) Avail: NTIS CSCL 22A

In order to determine the suitability of landing systems for a Mars lander spacecraft, it is necessary to study the landing-gear structural loads, vehicle loads, motions, and stability at Mars gravity and at full size. There is need of a practical and economical technique for conducting full-scale Earth tests which would augment small-scale model tests and analytical investigations. Therefore, dynamic models have been used to develop and evaluate a technique for simulating planetary gravity during landing-impact tests. Results from landings at simulated Martian gravity show good correlation with results obtained during free-body Earth-gravity landings. Impact accelerations, time histories, and gear strokes obtained during hard-surface landings with the simulated Martian gravity and the Earth-gravity techniques are in good agreement. Model behavior and overturn characteristics compare favorably. Results indicate that the simulator technique could be used to conduct model and full-scale landing-impact investigations of planetary landers at reduced gravity. Author

N71-36248*# Boeing Co., Houston, Tex. Space Div.

APOLLO OXYGEN TANK STRATIFICATION ANALYSIS, VOLUME 1 Final Report

J. E. Barton, H. W. Patterson, and D. D. Rule 31 Aug. 1971 106 p refs

(Contract NAS9-11576)

(NASA-CR-115143; D2-118406-1-Vol-1) Avail: NTIS CSCL 22B

An analysis of the Apollo oxygen tank stratified performance in the Apollo low g flight environment was conducted and the capability of the tank to satisfy mission requirements evaluated. The analysis used a stratification model which was available when the program was initiated November 1, 1970. The model solves the compressible viscous flow equations in a two-dimensional region representing the interior of the tank. Model improvements made to improve the accuracy and efficiency of performance simulations are described. Conditions analyzed included attitude hold and passive thermal control flight modes and a range of tank quantities and flow rates. The analysis of one period investigated included the effects of fluid rotations caused by a change in the vehicle rotation rate. The tank performance and model accuracy were evaluated by comparing simulated tank pressure and heater temperature with observed data. The tank performance was found to be adequate for known mission requirements. The model accurately simulated tank performance for all conditions with the exception of the fluid rotations which were three dimensional and could not be adequately modeled. Author

N71-36249# Gesellschaft fuer Weltraumforschung m.b.H., Bad Godesberg (West Germany).

[SPACE ACTIVITIES CONCERNING AZUR, AEROS, DIAL, HELIOS, AND EXPLORER 40 SATELLITES, ELDO LAUNCHER DEVELOPMENT, GROUND SUPPORT EQUIPMENT, SPACE ENVIRONMENT SIMULATORS, AND PLASMA ENGINES] Quarterly Report, 1 Jan. - 31 Mar. 1971 [GESELLSCHAFT FUER WELTRAUMFORSCUNG VIERTELJAHRESBERICHT, 1. JANUAR - 31. MAERZ 1971]

1971 13 p In GERMAN

(QB-1-71) Avail: NTIS

Various space activities concerning data evaluation from the Azur satellite, the development of the Aeros project and the Helios project, data evaluation from the Dial satellite, use of the Injun 5 (Explorer 40) satellite, ELDO launcher development, space environment simulators, plasma engines, and the associated costs are presented. ESRO

N71-36260# Picatinny Arsenal, Dover, N.J.

AN ANALYSIS OF DESIGN CONCEPTS FOR MECHANICAL SIMULATION OF MULTISTAGE FLIGHT ACCELERATION

S. Langdo and J. Cappetta Jul. 1971 24 p

(AD-726926; PA-TM-2008) Avail: NTIS CSCL 14/2

The report analyzes typical functional accelerator requirements and two proposed design concepts. The basic conclusion of this report is that the proposed "Track" concept appears to be technically feasible; offering considerable advantages over the variable radius centrifuge concept. Conventional centrifuge testing of functional requirements of arming and safing devices utilized in nuclear warhead adaption kits is unrealistic due to extremely high rates of change in acceleration which these items will experience in actual use. In order to assure proper functioning in flight, test equipment is required which will simulate the actual acceleration-time characteristics experienced. Author (GRA)

32 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic.

N71-36251*# Tennessee Technological Univ., Cookeville.

STRESS WAVES IN SANDWICH PLATES

Ray Kinslow Oct. 1970 49 p refs Presented at the 1970 SESA Fall Meeting, Boston, 18-22 Oct. 1970 /t: SESA Paper No. 1653

(Grant NGR-43-003-007)

(NASA-CR-121892) Avail: NTIS CSCL 20K

A mathematical stress wave model is formulated for use in predicting the effects of various material combinations and geometry in the design of sandwich plates that may be subjected to high velocity impact. In the experimental investigations the bounding layers were of a birefringent material and stresses were determined by means of a dynamic polariscope utilizing a high-speed framing camera. A comparison is made of the theoretical and experimental results. Author

N71-36252*# Translation Consultants, Ltd., Arlington, Va.
DIFFERENCE METHOD FOR THE SOLUTION OF THE SECOND BOUNDARY-VALUE STEADY-STATE PROBLEM OF THE THEORY OF ELASTICITY [RAZNOSTNAYA SKHEMA DLYA RESHENIYA VTOROY KRAYEVOY STATICHESKOY ZADACHI TEORII YPRUGOSTI]
B. Aliyev Washington NASA Sep. 1971 15 p refs Transl. into ENGLISH from Zh. Vychisl. Mat. i Mat. Fiz. (USSR), v. 10, no. 6, 1970 p 1481-1490
(Contract NASw-2038)
(NASA-TT-F-13566) Avail: NTIS CSCL 20K

The difference scheme for a differential equation of a steady-state problem of the theory of elasticity is examined. The existence of a solution of the difference problem is proved, indicating that the difference equation approximates the differential equation to the second order of approximation at interior points, and the boundary conditions are approximated at least to the first order of approximation. An a priori estimate is derived and the convergence of this linearly completed function to the solution is shown for a function of the difference problem. This is feasible if the solution is sufficiently continuous and a stable method of solving the difference equation is indicated.
Author

N71-36253*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
NASTRAN: USERS' EXPERIENCES
Washington Sep. 1971 785 p refs Colloq. held at Hampton, Va., 13-15 Sep. 1971
(NASA-TM-X-2378; L-7980) Avail: NTIS HC $9.00/MF $0.05 CSCL 20K

The application of the NASTRAN computer program to a wide variety of static and dynamic structural problems is discussed. The conference papers presented focus on vibrations, structural design, systems and operational problems, evaluations and innovations, and new capabilities for NASTRAN. For individual titles, see N71-36254 through N71-36305.

N71-36254*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
NASTRAN: STATUS, MAINTENANCE, AND FUTURE DEVELOPMENT OF NEW CAPABILITY
J. Philip Raney, Deene J. Weidman, and Howard M. Adelman *In its* NASTRAN: Users Experiences Sep. 1971 p 1-7 (See N71-36253 22-32)
Avail: NTIS HC $9.00/MF $0.95 CSCL 20K

The present status of NASTRAN (NASA Structural Analysis) is described and the goals and objectives for its future maintenance and development by the NASTRAN Systems Maintenance Office are outlined. The widespread acceptance of NASTRAN by NASA and other government agencies as the largest, most comprehensive, nonproprietary, general purpose, finite element computer system for structural analysis in existence today is discussed.
Author

N71-36255*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
CALCULATION OF STRESS CONCENTRATION DUE TO A HYPERBOLOID CAVITY IN A THIN PLATE USING NASTRAN
Phillip R. Wilcox *In its* NASTRAN: Users Experiences Sep. 1971 p 9-16 refs (See N71-36253 22-32)
Avail: NTIS HC $9.00/MF $0.95 CSCL 20K

NASTRAN has been used to calculate the stress concentration in a plate due to a hyperboloid cavity under biaxial loading. Details concerning the usage of the program, modeling of the structure, and a comparison between experimental and theoretical results are presented.
Author

N71-36256*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
NON-LINEAR CONSIDERATION OF GRAVITY IN A STIFFNESS TEST OF A WEAK STRUCTURE AT SMALL STRAINS
Ralph G. Barclay, Stuart L. Hanlein, John Sween, Jr., and Paul H. King *In its* NASTRAN: Users Experiences Sep. 1971 p17-26 (See N71-36253 22-32)
Avail: NTIS HC $9.00/MF $0.95 CSCL 20K

The NASTRAN computer program was used to calculate lateral deflections of a very weak spacecraft antenna boom, essentially a vertically-hung cantilever beam, under laboratory loading. The non-linear effect of gravity was included. The purpose of the test was to determine the boom stiffness at extremely small strains thus simulating the strain conditions produced by dynamic lateral deflections in orbit. The calculated deflections indicate that the determination should be possible however, large hysteresis effects were found to be present and stiffness results have not yet been determined.
Author

N71-36257*# Teledyne Brown Engineering, Huntsville, Ala.
SKYLAB 1 NASTRAN STRESS ANALYSIS MODELS
William S. Viall *In* NASA. Langley Res. Center NASTRAN: Users Experiences Sep. 1971 p 27-46 (See N71-36253 22-32)
Avail: NTIS HC $9.00/MF $0.95 CSCL 20K

The use of NASTRAN with stress analysis models of the Apollo Telescope Mount (ATM) and the Orbital workshop Stage (OWS) is discussed. The models considered are for Rigid Format (SOL 1,0) type analyses of space frames, stiffened cylinders, complex stiffened bulkheads, and simple panels with complex loading. The NASTRAN features that simplify rigid format static analyses are discussed. These features include grid-point sequencing, multiple coordinate systems, user master files, restart, bar-offset vectors, sufficient element catalog, and boundary condition options.
Author

N71-36258*# Lockheed-California Co., Burbank.
SOME ASPECTS OF NASTRAN SOLUTION ACCURACY
Gernot W. Haggenmacher *In* NASA. Langley Res. Center NASTRAN: Users Experiences Sep. 1971 p 47-63 (See N71-36253 22-32)
Avail: NTIS HC $9.00/MF $0.95 CSCL 20K

Various aspects of the accuracy of a NASTRAN solution for static and structural stability analysis have been explored by a series of specific examples, and the results have been evaluated. Using examples for which closed-form solutions were available, the following problems were investigated: numerical accuracy of the static solution using the example of a cantilever beam; accuracy of column buckling; hydrostatic buckling of an arch; plate buckling in compression; and accuracy of membrane and plate element elastic properties.
Author

N71-36259*# Teledyne Brown Engineering, Huntsville, Ala.
A NASTRAN BUCKLING ANALYSIS OF A LARGE STIFFENED CYLINDRICAL SHELL WITH A CUTOUT
Richard H. Brolliar *In* NASA. Langley Res. Center NASTRAN: Users Experiences Sep. 1971 p 65-84 refs (See N71-36253 22-32)
Avail: NTIS HC $9.00/MF $0.95 CSCL 20K

A buckling analysis of the Skylab Workshop (SWS) cylinder window region is presented. The Skylab Workshop is a waffle-stiffened cylinder with a cutout for the window. The criterion used in deciding how large a portion of the cylinder to model and what degree of grid refinement to use is explained. Test cases are presented which show that NASTRAN has the capability to handle cylinder panel buckling problems if a sufficiently fine grid point pattern is used. The problems encountered in obtaining eigenvalues for large matrices are discussed, and the importance of restraint of rotation about the radial axis at each grid point is explained.
Author

N71-36260*# Vought Aeronautics, Dallas, Tex.
NASTRAN DIFFERENTIAL STIFFNESS ANALYSIS OF AN AIRCRAFT CANOPY

Robert D. Bennett *In* NASA. Langley Res. Center NASTRAN: Users Experiences Sep. 1971 p 85-105 ref (See N71-36253 22-32)
Avail: NTIS HC $9.00/MF $0.95 CSCL 20K

Comparisons of internal member loads and stresses as generated by the NASTRAN differential stiffness and static analysis methods are presented for a tandem side opening canopy. A description of the structure analyzed and the load condition for which it is analyzed are included along with several computer and hand generated plots. The comparisons of the two methods show a general decrease in the internal member loads obtained by the differential stiffness method of analysis over the static method of analysis. Author

N71-36261*# Sperry Rand Corp., Huntsville, Ala.
APPLICATION OF SMALL AND LARGE DISPLACEMENT THEORY TO A LARGE FLEXIBLE SOLAR ARRAY AND COMPARISON WITH STATIC TEST RESULTS
Ronald P. Schmitz *In* NASA. Langley Res. Center NASTRAN: Users Experiences Sep. 1971 p 107-121 refs (See N71-36253 22-32)
Avail: NTIS HC $9.00/MF $0.95 CSCL 20K

The NASTRAN program was used to perform a structural analysis of the Apollo Telescope Mount (ATM) solar array wing. A high fidelity model containing 8286 DOF was used for the launch (cinched) and orbital (deployed) configurations. Extensive use was made of the multi-point constraint feature of NASTRAN to obtain proper load paths for the launch configuration and of the local coordinate feature to define subassemblies within the global coordinate system. Changes in configuration from deployed to cinched were obtained by rotating and translating the local coordinate systems. Static and differential stiffness solutions were obtained. Comparisons were made between these results and static load tests. Author

N71-36262*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
STATIC ANALYSIS OF THE 64-m (210-FT) ANTENNA REFLECTOR STRUCTURE
M. Smoot Katow *In* NASA. Langley Res. Center NASTRAN: Users Experiences Sep. 1971 p 123-139 refs (See N71-36253 22-32)
(Contract NAS7-100)
Avail: NTIS CSCL 20K

Progressing from a space frame analysis using only prismatic bars connected at frictionless pin joints and one quadrant of input data, the structural model of the 64-m diameter reflector structure was upgraded with the use of the NASTRAN program. Bars with bending resistance and plates were added at appropriate locations. The deflection results computed for the gravity loading case are closely correlated to field measured values and operational RF tests. Expansion of the input data to 1/2 structure permitted studies of minor structural modifications which, if implemented, should result in lower deformations from gravity loads. Procedures used to check for correct input data are noted. Author

N71-36263*# Communications Satellite Corp., Washington, D.C.
NASTRAN-GAP: AN INTEGRATED APPROACH TO THE ANALYSIS OF RADIATION PATTERNS OF DISTORTED REFLECTORS c07
William L. Cook *In* NASA. Langley Res. Center NASTRAN: Users Experiences Sep. 1971 p 141-161 refs (See N71-36253 22-32)
Avail: NTIS HC $9.00/MF $0.95 CSCL 20N

The COMSAT general antenna package (GAP), when used in conjunction with the NASTRAN Structural Analysis Program, provides the capability for directly determining the effects of structural distortions on reflecting antenna patterns. An important feature of the GAP program is that the data format for coordinate systems, element definitions, grid point locations and displacements is identical to that of the NASTRAN program, thereby eliminating the necessity for data conversion and minimizing the ambiguity which often arises in the description of a program in two distinct engineering disciplines. The analysis procedures in GAP are specifically designed to accommodate finite element data in an efficient manner. In particular a displacement function is assumed for each surface element which is completely analogous to that used in the finite element derivation. To demonstrate the capabilities of NASTRAN-GAP as an analysis tool, the radiation pattern from a parabolic reflector is calculated for both gravity and thermal loads. Author

N71-36264*# North American Rockwell Corp., Downey, Calif. Space Div.
ANALYSIS OF A HOT ELEVON STRUCTURE
H. W. Bergmann, James C. Robinson (NASA. Langley Res. Center), and Howard M. Adelman (NASA. Langley Res. Center) *In* NASA. Langley Res. Center NASTRAN: Users Experiences Sep. 1971 p 163-180 refs (See N71-36253 22-32)
Avail: NTIS HC $9.00/MF $0.95 CSCL 20K

The analysis of hot structures by the finite element method poses the problem of adequate structural modeling within the scope of existing computer programs for severe thermal gradients and also modeling provisions for thermal expansion. An approach to the modeling and the subsequent analysis of a hot elevon test article is discribed. Solutions were obtained by the ASKA and the NASTRAN programs to evaluate some of their performance characteristics. Author

N71-36265*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
NASTRAN MODELING STUDIES IN THE NORMAL MODE METHOD AND NORMAL MODE SYNTHESIS
Roy Leon Courtney *In its* NASTRAN: Users Experiences Sep. 1971 p 181-199 refs (See N71-36253 22-32)
Avail: NTIS HC $9.00/MF $0.95 CSCL 20K

The results of finite element and analytic solutions of the normal modes of a uniform beam under various end conditions are compared. The normal modes of a single component are synthesized to represent different single-component and multicomponent structures. The results are compared for accuracy with the analytic structural solutions. Guidelines for finite element structural modeling are developed which determine the minimum number of elements required to obtain specified levels of accuracy in normal mode analysis and synthesis. The finite element modeling studies are implemented on NASA's NASTRAN structural analysis computer program. Modeling techniques that represent a part of a structure by its normal modes in a computer structural analysis are presented. Author

N71-36266*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
GUYAN REDUCTION SOLUTIONS RECYCLED FOR IMPROVED ACCURACY c19
Roy Levy *In* NASA. Langley Res. Center NASTRAN: Users Experience Sep. 1971 p 201-220 refs (See N71-36253 22-32)
(Contract NAS7-100)
Avail: NTIS HC $9.00/MF $0.95 CSCL 12A

The accuracy of conventional solutions of the eigenvalue problem by means of the Guyan reduction method is examined for analytical models of several practical structures. Evaluations are made of eigenvalue accuracy with respect to the relative numbers of retained indicator degrees of freedom. When a relatively small number of indicator degrees of freedom are employed, solutions are likely to be inaccurate unless prior knowledge of the mode shapes is used in selecting these degrees of freedom. One improvement for recovering the lowest modes is to supplement the indicator displacements with static loading displacement functions. A further, and more powerful remedy is to perform iterative repetitions of the solution procedure by extending Stodola's method of matrix iteration, which operates with one eigenvector at a time to a block

iteration operating on a group of vectors simultaneously. This de-emphasizes the need for a judicious selection of indicators. Great improvements in accuracy can be achieved with only a few iterative cycles and relatively small numbers of retained degrees of freedom. This method is effective when only a few valid modal solutions are required and the order of the matrix is so large that the computational time without reduction would ordinarily be prohibitive. Author

N71-36267*# General Dynamics/Convair, San Diego, Calif. Aerospace Div.
MODAL ANALYSIS OF THE MATED SPACE SHUTTLE CONFIGURATION
R. K. Gieseke *In* NASA. Langley Res. Center NASTRAN: Users Experiences Sep. 1971 p 221-236 ref (See N71-36253 22-32)
Avail: NTIS HC $9.00/MF $0.95 CSCL 22B

The development of analytical dynamic models for the space shuttle system is traced from simplified early visions through current models of complex representation. The sequence of models also displays changes in design that have occurred during configuration definition and development activities. Alterations to the analytical models for accuracy of representation and improved graphical display are explained. A discussion is included that examines the program characteristics of NASTRAN, particularly as it operates within the environment of the computer monitor system and influences the analysis procedure. Author

N71-36268*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
NORMAL MODE ANALYSIS OF THE RADIO ASTRONOMY EXPLORER (RAE) BOOMS AND SPACECRAFT
K. N. Jabbour *In its* NASTRAN: Users Experiences Sep. 1971 p 237-249 refs (See N71-36253 22-32)
Avail: NTIS HC $9.00/MF $0.95 CSCL 22B

The problem of determining the normal modes of RAE booms and spacecraft for in-flight configuration is analyzed. The solution is based on the use of a finite element model of the booms and spacecraft along with NASTRAN's normal mode anslysis. The inverse power method of eigenvalue extraction was utilized. The results are presented as a summary of real eigenvalues and plots of the six rigid body mode shapes, the eight first mode shapes, and the eight second mode shapes. The study showed that considerable care must be exercised when using NASTRAN in the solution of complex problems. Author

N71-36269*# Naval Air Development Center, Johnsville, Pa.
STATIC AND DYNAMIC ANALYSIS, F-14A BORON HORIZONTAL STABILIZER
S. L. Huang and H. Rubin *In* NASA. Langley Res. Center NASTRAN: Users Experiences Sep. 1971 p 251-264 (See N71-36253 22-32)
Avail: NTIS HC $9.00/MF $0.95 CSCL 01A

A static stress analysis and a dynamic modal analysis of the horizontal stabilizer of the F-14A aircraft has been conducted employing the NASTRAN program. The structural model contains 1518 elements including bars, rods, shear panels and orthotropic and isotropic membrane elements with 1357 degrees of freedom. Static deflection and stresses, including thermal stresses, under maximum load at room and at elevated temperatures are calculated and results are in good agreement with experimental data. Through application of Guyan Reduction the number of degrees of freedom used in the dynamic analysis is reduced to 137. The frequencies and mode shapes for the first two modes are obtained. Author

N71-36270*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ADAPTATION OF NASTRAN TO THE ANALYSIS OF THE VIKING SPACE VEHICLE
Thomas C. Jones and Larry D. Pinson *In its* NASTRAN: Users Experiences Sep. 1971 p 265-284 refs (See N71-36253 22-32)
Avail: NTIS HC $9.00/MF $0.95 CSCL 22B

A normal mode analysis of the complete Viking launch vehicle (stage 1-shutdown configuration) using a modification of NASTRAN version (11.1.0) on the CDC 6600 computer system is presented. The operational and logistics problems discussed are typical of those encountered in the use of NASTRAN for any large problem. The vehicle is divided into three basic substructures which are modeled and checked separately, then joined to yield a complete, unreduced model of the system. Eigenvalues are extracted using the inverse power method. The results demonstrate the broad versatility of NASTRAN for simultaneously modeling structures by direct matrix input, general elements, and rigid links along with the standard library of finite elements. It also indicates the large computer time requirements of NASTRAN for extracting roots of large order matrices. Author

N71-36271*# MacNeal-Schwendler Corp., San Marino, Calif.
ACOUSTIC ANALYSIS OF SOLID ROCKET MOTOR CAVITIES BY A FINITE ELEMENT METHOD c28
David N. Herting, Jerrard A. Joseph, Loren R. Kuusinen, and Richard H. MacNeal *In* NASA. Langley Res. Center NASTRAN: Users Experiences Sep. 1971 p 285-324 refs (See N71-36253 22-32)
Avail: NTIS HC $9.00/MF $0.95 CSCL 21H

A description is given of an approach to the solution of acoustic modes in a cavity containing both axisymmetric regions and evenly spaced radial slots. A finite element approach is used with degrees of freedom taken as the harmonic coefficients in a Fourier expansion of the pressure. If the assumptions are made that the radial slots are evenly spaced around the circumference and that the circumferential pressure gradient within each slot is negligible, the equations for the harmonic coefficients become uncoupled. Formulas are derived by which the finite element stiffness and mass matrices may be computed. In addition, special terms are derived to account for rapid expansion of the flow in the opening between the slots and the circular cavity. Results are given for three operational solid rocket motors having four, six, and twelve radial slots respectively. Comparisons with other analytic results and with experimental results are given where these data are available. Author

N71-36272*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
PRACTICAL ANALYSIS OF PLATE VIBRATIONS USING NASTRAN
Robert R. Clary *In its* NASTRAN: Users Experiences Sep. 1971 p 325-341 refs (See N71-36253 22-32)
Avail: NTIS HC $9.00/MF $0.95 CSCL 20K

The successful application of the NASA structural analysis (NASTRAN) computer program for calculating the vibration characteristics of a variety of plate configurations is described. Calculated natural frequencies and nodal patterns are generally in good agreement with measured data for (1) research filamentary composite material plates, (2) wing flutter models fabricated with metal reinforced with composite material, and (3) a metal plate supported on an elastic boundary. Author

N71-36273*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
MODAL ANALYSIS OF A NINE-BAY SKIN-STRINGER PANEL
Robert E. Grandle and Carl E. Rucker *In its* NASTRAN: Users Experiences Sep. 1971 p 343-361 (See N71-36253 22-32)
Avail: NTIS HC $9.00/MF $0.95 CSCL 20K

The results obtained using a NASTRAN normal mode analysis of a nine-bay skin-stringer panel 68.58 cm (27 inches) by 93.98 cm (37 inches) of typical aircraft construction are presented. The aluminum panel was made up of a plate, Z section stringers, and channel section frames and was assumed to have fully fixed edges. Stress and mode shape data

for the lower order modes obtained from a NASTRAN analysis of a 266-grid-point division of the panel are presented and compared with experimental data. Author

N71-36274*# Sperry Rand Corp., Huntsville, Ala. Space Support Div.
STRUCTURAL DYNAMIC ANALYSIS OF ELECTRONIC ASSEMBLIES USING NASTRAN RESTART/FORMAT CHANGE CAPABILITY
Ronald P. Schmitz *In* NASA. Langley Res. Center NASTRAN: Users Experiences Sep. 1971 p 363-391 refs (See N71-36253 22-32)
Avail: NTIS HC $9.00/MF $0.95 CSCL 20K

The application of the NASTRAN program to structural dynamic response of electronic packaging and support structure is discussed. The structure modeled and analyzed was the experiment support system assembly (ESS) of the skylab orbital workshop. The analysis used three rigid formats: eigenvalue analysis (Format 3), frequency response (Format 11) and static analysis (Format 1). The same model was used for each analysis using NASTRAN's checkpoint/restart/format change capability. Geometry plotting and xy plotting were used to illustrate the mode shapes and acceleration response. Author

N71-36275*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE RESPONSE OF SHELLS TO DISTRIBUTED RANDOM LOADS USING NASTRAN
Gary K. Jones *In its* NASTRAN: Users Experiences Sep. 1971 p 393-406 ref (See N71-36253 22-32)
Avail: NTIS HC $9.00/MF $0.95 CSCL 20K

The performance of the NASTRAN modal random response analysis, rigid format 11, was investigated using a hypothetical stiffened cylindrical shell excited by a simulated turbulent boundary layer pressure field. The cylindrical shell (2.54 meters in diameter, 3.353 meters in length) was simply supported at both ends. In order to assess the effect of the model detail on the results, two models were developed. One model had 360 degrees of freedom and the other 720 degrees of freedom. The real part of the forcing function (co-spectral density) was represented by an exponentially decaying cosine function and the imaginary part of the forcing function (quad-spectral density) was represented by an exponentially decaying sine function. Problems associated with NASTRAN operations were encountered, but to a large extent, were successfully resolved. Only the random response (displacement spectral density) obtained for the 360 d.o.f. model is presented. No response data for the complex model (720 d.o.f.) is presented. Author

N71-36276*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
APPLICATIONS OF NASTRAN TO COUPLED STRUCTURAL AND HYDRODYNAMIC RESPONSES IN AIRCRAFT HYDRAULIC SYSTEMS
James T. Howlett *In its* NASTRAN: Users Experiences Sep. 1971 p 407-419 refs (See N71-36253 22-32)
Avail: NTIS HC $9.00/MF $0.95 CSCL 20K

It is demonstrated that the NASTRAN computer program can be used to analyze the coupled fluid and structural responses of multibranch pipes as occur in aircraft hydraulic systems. The techniques used to model hydraulic lines with NASTRAN are explained. Example problems are presented which demonstrate the validity of the analytical model for a simple standpipe system and which demonstrate that the technique is promising as a basis for detailed dynamic analysis of hydraulic systems of actual aircraft. Author

N71-36277*# Old Dominion Univ., Norfolk, Va.
APPLICATION OF NASTRAN TO A SPACE SHUTTLE DYNAMICS MODEL
E. A. Thornton *In* NASA. Langley Res. Center NASTRAN: Users Experiences Sep. 1971 p 421-437 refs (See N71-36253 22-32)
Avail: NTIS HC $9.00/MF $0.95 CSCL 22B

A NASTRAN analysis of the normal modes of a 1/15 scale space shuttle dynamics model is described. Fuselage and wing components were analyzed first in a free-free condition and then assembled to give the complete model. The finite element idealization employed bar elements, concentrated masses, general elements and modeled rigid connections using multipoint equations of constraint. A Guyan reduction was used, and the eigenvalue problem for the complete model was solved using the Givens method. Author

N71-36278*# Teledyne Brown Engineering, Huntsville, Ala.
COMPLEX EIGENVALUE SOLUTION TO A SPINNING SKYLAB PROBLEM c19
Jayant S. Patel and S. M. Seltzer (NASA. Marshall Space Flight Center) *In* NASA. Langley Res. Center NASTRAN: Users Experiences Sep. 1971 p 439-449 ref (See N71-36253 22-32)
Avail: NTIS HC $9.00/MF $0.95 CSCL 12A

The effect of rotation on the structural and dynamic behavior of a spinning body with flexible appendages was demonstrated. The feasibility of including this effect in a digital simulation which requires a complex eigenvalue solution to a fairly high order system is indicated. The eigenvalue problem associated with solar panels attached to the Skylab Apollo telescope mount and orbital workshop is idealized into a 102 degrees-of-freedom system and solved. To facilitate the analysis, eigenvalues of an L-beam with six-lumped masses and 36 degrees-of-freedom are illustrated. The results show that it is important to retain the geometric stiffness matrix. The lowest natural frequency corresponds to the vibrations of the masses in the plane of rotation. It is the frequency which is substantially affected by the spin rate, even with a relatively slow spin rate which is less than the fundamental natural frequency. E.M.C.

N71-36279*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
APPLICATION OF NASTRAN TO THE ANALYSIS OF A SPACE SHUTTLE ORBITER STRUCTURE
Gary L. Giles and John H. Dutton (McDonnell-Douglas Co., St. Louis, Mo.) *In its* NASTRAN: Users Experiences Sep. 1971 p 451-464 refs (See N71-36253 22-32)
Avail: NTIS HC $9.00/MF $0.95 CSCL 22B

The NASTRAN program was used to analyze a space shuttle orbiter finite element model with over 3000 joint degrees of freedom. The model has structural members sized using the fully stressed design procedure in the Automated Structural Design (ASD) program. To date, conversion to the NASTRAN format of the topological ASD input data for the complete vehicle and conversion of eight wing loading conditions has been completed. In addition, a structural analysis of the orbiter wing has been completed. The effort required to convert the data is discussed, and basic differences in the two finite element programs are described. Also, the performances of the NASTRAN and ASD programs are compared in terms of calculated quantities such as stresses and displacements, and in computational time required for a single analysis cycle of the orbiter wing structure. Author

N71-36280*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
NASTRAN AS ANALYSIS TOOL IN A STRUCTURAL DESIGN OPTIMIZATION PROCESS
J. E. Sobieszczanski and D. D. Loendorf (Army Air Mobility Res. and Develop. Lab., Fort Eustis, Va.) *In its* NASTRAN: Users Experiences Sep. 1971 p 465-476 refs (See N71-36253 22-32)
Avail: NTIS HC $9.00/MF $0.95 CSCL 20K

The use of NASTRAN as the analysis tool in a structural design process is described. A section of an aircraft fuselage type structure with rings, stringers, and skin idealized by 408 finite elements and 858 degrees of freedom was optimized in an

analysis evaluation and redesign closed cycle. NASTRAN was employed in the analysis step, with the evaluation and redesign steps supported by separate programs, and data transfer was carried out by hand. This procedure proved to be workable with turn-around time for one redesign cycle requiring one day. Approximately five redesign cycles were needed to converge to an optimized design. Author

N71-36281*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
STRUCTURAL ANALYSIS AND DESIGN OPTIMIZATION OF SPACECRAFT USING NASTRAN
Roy L. Courtney *In its* NASTRAN: Users Experiences Sep. 1971 p 479-491 refs (See N71-36253 22-32)
Avail: NTIS HC $9.00/MF $0.95 CSCL 22B

Typical conclusions from NASTRAN analysis of spacecraft structures include the following: recommended structural arrangement for optimal loading and efficient structural components evolved through concept or evaluation of the entire spacecraft, and specific values of engineering design parameters (e.g., stress and deflection) for selected structures determined through models of individual components. E.M.C.

N71-36282*# Lockheed-California Co., Burbank.
THE USE OF NASTRAN IN THE ANALYSIS OF LARGE COMPLEX AIRFRAME STRUCTURES: MODELING TECHNIQUES AND ORGANIZATION
Gernot W. Haggenmacher *In* NASA. Langley Res. Center NASTRAN: Users Experiences Sep. 1971 p 493-515 (See N71-36253 22-32)
Avail: NTIS HC $9.00/MF $0.95 CSCL 01A

The NASTRAN system has been found to be very versatile, fairly easy to use when following the rigid format, with many outstanding features, and as a practical tool for large scale aircraft analysis. A brief evaluation of the NASTRAN system based predominantly on a large airframe analysis is presented. E.M.C.

N71-36283*# Computer Sciences Corp., Silver Spring, Md.
NASTRAN DOCUMENTATION FROM AN HISTORICAL VIEWPOINT c34
Frank J. Douglas *In* NASA. Langley Res. Center NASTRAN: Users Experiences Sep. 1971 p 517-531 refs (See N71-36253 22-32)
Avail: NTIS HC $9.00/MF $0.95 CSCL 05B

The management approach to NASTRAN documentation is reviewed in an effort to improve the system, and the technical approach is discussed with emphasis on specifications and standards. It is concluded that the maintenance of NASTRAN documentation is adequate after examination with respect to the two updates already made. The appendix provides a list of the style and format specifications used in NASTRAN documentation. E.M.C.

N71-36284*# Boeing Co., Renton, Wash.
DATA MANAGEMENT REQUIREMENTS FOR LARGE PROBLEMS c08
Stanley D. Hansen and Harold B. Hansteen *In* NASA. Langley Res. Center NASTRAN: Users Experiences Sep. 1971 p 533-550 (See N71-36253 22-32)
Avail: NTIS HC $9.00/MF $0.95 CSCL 09B

It is recommended that the NASTRAN computer code can be configured to interface with the requirements of other finite element computer programs utilized in production analyses such as those employed in the 747 and SST airframes. Substructuring is also shown to be a necessary tactic for the processing of large finite element problems. E.M.C.

N71-36285*# National Aeronautics and Space Administration, Washington, D.C.
NASA TECHNOLOGY TRANSFER: THE COMPUTER SOFTWARE DISSEMINATION PROGRAM c08
Joseph M. Carlson *In its* NASTRAN: Users Experiences Sep. 1971 p 551-552 (See N71-36253 22-32)
Avail: NTIS HC $9.00/MF $0.95 CSCL 09B

The development and operation of the Computer Software Management and Information Center (COSMIC) is discussed. The NASTRAN program, originally generated in response to NASA mission requirements, is cited as an example of publicly available software that has provided significant economic and technical benefits to private sectors. J.G.M.

N71-36286*# General Dynamics/Convair, San Diego, Calif.
NASTRAN EXPERIENCES OF FORT WORTH OPERATION, CONVAIR AEROSPACE DIVISION OF GENERAL DYNAMICS c08
Merle Allen *In* NASA. Langley Res. Center NASTRAN: Users Experiences Sep. 1971 p 553-558 (See N71-36253 22-32)
Avail: NTIS HC $9.00/MF $0.95 CSCL 09B

The preliminary and updated versions of NASTRAN were acquired and implemented on the IBM-360 computing system. After implementation of the preliminary version (level 8.1.0), a series of small exploratory problems were solved to determine the procedure's accuracy, usability, and economy. Seven of the rigid formats and DMAP were used. Structure and x-y plots were obtained. The results indicate that NASTRAN is easy to use and is accurate. It is not economical for small problems because it is both general purpose and programmed for large problems. Author

N71-36287*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A SPECIAL NASTRAN PROGRAM FOR INPUT CHECKING AND UNDEFORMED STRUCTURE PLOTTING c08
Willianna W. Smith *In its* NASTRAN: Users Experiences Sep. 1971 p 559-568 (See N71-36253 22-32)
Avail: NTIS HC $9.00/MF $0.95 CSCL 09B

The possibility is investigated of providing the NASTRAN user the capabilities of having his input data deck checked and a plot of the undeformed structure produced. Because of the queuing priorities for operating systems built around multiprograming techniques and the hardware requirements for execution (core, disk storage, etc.), a maximum of 28,672 words (70K octal) of central memory was chosen as a desirable field length to attain. A program of this size would not only allow for more rapid access to the computer, but would permit job submittals through remote terminal facilities. In addition, the program was to be generated from the current level of NASTRAN in such a way that it could be easily updated for future levels if necessary. Author

N71-36288*# MacNeal-Schwendler Corp., San Marino, Calif.
EXPERIENCES IN NASTRAN INSTALLATION AND TRAINING c11
Caleb W. McCormick *In* NASA. Langley Res. Center NASTRAN: Users Experiences Sep. 1971 p 569-575 (See N71-36253 22-32)
Avail: NTIS HC $9.00/MF $0.95 CSCL 14B

The experiences of The MacNeal-Schwendler Corporation in NASTRAN installation and training are reviewed. Experiences in installation cover a wide variety of computers and a number of different operating systems. Training periods have varied from one or two days, directed at specific applications, up to two weeks or more covering both static and dynamic analysis. Author

N71-36289*# Computer Sciences Corp., Silver Spring, Md.
NASTRAN INSTALLATION: IMPLEMENTATION STEPS AND POSSIBLE PROBLEMS ENCOUNTERED c11
Howard E. Dielmann *In* NASA. Langley Res. Center NASTRAN: Users Experiences Sep. 1971 p 577-586 ref (See N71-36253 22-32)
Avail: NTIS HC $9.00/MF $0.95 CSCL 14B

NASTRAN is currently installed and operating on the CDC 6600, the IBM 360, and the UNIVAC 1108. The steps found by CSC to be necessary in installing NASTRAN on a computer system and the possible obstacles that might be encountered in undertaking NASTRAN installation are discussed. Reference is made to actual problems that arose during installation on the above machines. Author

N71-36280*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
AN EVALUATION OF CURRENT NASTRAN DISCRETE ELEMENT MODELS FOR MONOCOQUE AND SEMIMONOCOQUE STRUCTURES
Edward L. Stanton and William F. Bozich *In* NASA. Langley Res. Center NASTRAN: Users Experiences Sep. 1971 p 587-625 refs (See N71-36253 22-32)
(Contracts NAS9-6555; F04701-70-c-0159)
Avail: NTIS HC $9.00/MF $0.95 CSCL 20K

The current discrete element analysis models in NASTRAN, Levels 8.1.0 and 11.1.0, are evaluated for semi-monocoque and monocoque structures. Comparative results are presented with the FORMAT-3 general-purpose code for a swept wing statics analysis and a Skylab substructure vibration analysis. Good agreement between Level 11.1.0 and FORMAT-3 is demonstrated; however, a major error in Level 8.1.0 was discovered on the Skylab vibration problem. The computational performance of NASTRAN was superior to FORMAT, but the vibration rigid format was found to have several inefficiencies. Comparative results are also presented between Level 11.1.0 and STACUSS, SLADE, BOND, UNIVALVE, and another special-purpose code. Results for two of the structures analyzed, a cylindrical shell and an elliptic plate, indicate curved discrete elements are significantly more accurate than the plate elements in NASTRAN for the same number of degrees of freedom. Author

N71-36291*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SAVINGS IN NASTRAN DECOMPOSITION TIME BY SEQUENCING TO REDUCE ACTIVE COLUMNS c08
R. Levy and S. Wall *In* NASA. Langley Res. Center NASTRAN: Users Experiences Sep. 1971 p 627-631 refs (See N71-36253 22-32)
(Contract NAS7-100)
Avail: NTIS HC $9.00/MF $0.95 CSCL 09B

In large-capacity computer programs for structural analysis, computational efficiency is improved and core storage requirements are reduced by taking advantage of the typical sparseness in the stiffness matrix. A reordering procedure is discussed which has the goal of reducing matrix wavefront. When applied to the NASTRAN program, this is equivalent to the reduction of the number of active columns for zero bandwidth. Comparisons are supplied that show the relative compactness that can be achieved for practical structural models with wavefront sequencing and with bandwidth sequencing. Examples show that wavefront sequencing can produce savings in the time required for subsequent decomposition of the stiffness matrix. Author

N71-36292*# Naval Ship Research and Development Center, Washington, D.C.
NEW ELEMENT DEFINITION CAPABILITY FOR NASTRAN c08
Myles M. Hurwitz and Michael E. Golden *In* NASA. Langley Res. Center NASTRAN: Users Experiences Sep. 1971 p 633-636 (See N71-36253 22-32)
Avail: NTIS HC $9.00/MF $0.95 CSCL 09B

A NASTRAN preprocessor, a new element definition capability, is described which an analyst may use to generate the NASTRAN tables and routines required for a new element. The preprocessor is written in the string-manipulation language SNOBOL Author

N71-36293*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
VIBRATION STUDIES OF A FLAT PLATE AND A BUILT-UP WING
James H. Starnes, Jr. *In its* NASTRAN: Users Experiences Sep. 1971 p 637-646 refs (See N71-36253 22-32)
Avail: NTIS HC $9.00/MF $0.95 CSCL 01A

The natural vibration frequencies of a clamped flat plate and a built-up wing were computed by two different finite element computer programs and compared with existing experimental data. The results indicate that by using a finite element program it is possible to obtain the accuracy desired for parametric design studies even for complex built-up structures. However, the differences in central processing unit execution times between the two programs revealed that it is economically feasible to develop automated design procedures or make parametric design studies involving many iterations only if computer programs tailored for very efficient operation are available. Author

N71-36294*# General Dynamics/Convair, San Diego, Calif.
PRODUCTION OF MOTION PICTURES OF A CONTINUOUSLY DEFORMING STRUCTURE USING NASTRAN c14
Robert J. Reynolds *In* NASA. Langley Res. Center NASTRAN: Users Experiences Sep. 1971 p 647-657 ref (See N71-36253 22-32)
Avail: NTIS HC $9.00/MF $0.95 CSCL 14E

An in-house program (MIDAS 4) was developed to determine the transient response of an elastic structure under the influence of numerous complex boundary constraint conditions. With the aid of a small intermediate FORTRAN processor, the output from MIDAS 4 was input to NASTRAN. Under the control of a user-developed DMAP set of instructions, NASTRAN produced SC-4020 output, suitable for 16mm projection, of the time-varying motion of a continuously deforming structure. Author

N71-36295*# General Dynamics/Convair, San Diego, Calif.
AN INTERACTIVE COMPUTER GRAPHICS PROGRAM FOR NASTRAN c08
Michael Cronk *In* NASA. Langley Res. Center NASTRAN: Users Experiences Sep. 1971 p 659-667 (See N71-36253 22-32)
Avail: NTIS HC $9.00/MF $0.95 CSCL 09B

A computer graphics program applied to NASTRAN is described that has resulted in cost savings in model checkout and increased flexibility in the use of NASTRAN. Shortcomings in using the NASTRAN structure plotter and advantages of an on-line interactive graphics program are discussed. Program features such as arbitrarily oriented three-dimensional views of beams, quadrilaterals, loads, constraints, and member sizes are described. Preliminary results are presented to indicate the flexibility of the interactive approach to model checkout. Future additions to the CDC 6400 program for reviewing analysis results are indicated. Author

N71-36296*# Boeing Co., Seattle, Wash.
NASTRAN USER INTERFACES: AUTOMATED INPUT INNOVATIONS c08
Malcolm W. Ice *In* NASA. Langley Res. Center NASTRAN: Users Experiences Sep. 1971 p 669-678 refs (See N71-36253 22-32)
Avail: NTIS HC $9.00/MF $0.95 CSCL 09B

The features which were incorporated to make the usage of the IBM 360 version of NASTRAN easier and less susceptible to error are described including automatic generation of finite element input, BCD/EBCDIC input transparency, and additional symbolic parameters in the NASTRAN user procedure. Author

N71-36297*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
PROCEDURE FOR EFFICIENTLY GENERATING, CHECK-

ING, AND DISPLAYING NASTRAN INPUT AND OUTPUT DATA FOR ANALYSIS OF AEROSPACE VEHICLE STRUCTURES c08

Gary L. Giles and Charles L. Blackburn (Avco Corp., Nashville, Tenn.) *In its* NASTRAN: Users Experiences Sep. 1971 p 679-696 refs (See N71-36253 22-32)

Avail: NTIS HC $9.00/MF $0.95 CSCL 09B

Auxiliary computer routines are discussed which automatically generate input data for a wide variety of aerospace vehicles and graphically display output data in the form of contour plots for use with the NASTRAN analysis program. The routines offer a significant savings in man-hours required to develop a finite element model and to interpret the data resulting from an analysis. The input data routines provide a capability for developing large reliable finite element models from a minimum amount of basic data pertaining to the external shape of the vehicle. For preliminary design studies, design changes can be accomplished with substantial time reductions by using such routines. The contour plots of the output data allow for rapid evaluation of the voluminous results obtained in such studies.

Author

N71-36298*# North American Rockwell Corp., Downey, Calif.

VEHICLE STRUCTURAL ANALYSIS: PRE AND POST PROCESSOR DATA HANDLING

T. Furuike and S. Yahata *In* NASA. Langley Res. Center NASTRAN: Users Experiences Sep. 1971 p 697-707 refs (See N71-36253 22-32)

Avail: NTIS HC $9.00/MF $0.95 CSCL 20K

Various pre-; intermediate-, and post-processor programs for data management in support of large finite element programs such as NASTRAN and ASKA are discussed. Data handling for the finite element model and multiple level substructing in spacecraft structural analysis are included.

J.M.

N71-36299*# Computer Sciences Corp., Silver Spring, Md.

NASTRAN PLOTTING CAPABILITIES c08

John R. McDonough *In* NASA. Langley Res. Center NASTRAN: Users Experiences Sep. 1971 p 709-735 refs (See N71-36253 22-32)

Avail: NTIS HC $9.00/MF $0.95 CSCL 09B

Plotting improvements and techniques for NASTRAN static, modal and transient analyses plots are discussed. The five common software functions performed by all the plot generating routines are reviewed. Static rigid, modal rigid, and transient rigid format plotting are illustrated using a delta wing analysis problem.

J.M.

N71-36300*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

A NASTRAN POSTPROCESSOR FOR STRUCTURAL MODIFICATION REANALYSIS

Roy Levy *In* NASA. Langley Res. Center NASTRAN: Users Experiences Sep. 1971 p 737-747 refs (See N71-36253 22-32)

(Contract NAS7-100)

Avail: NTIS HC $9.00/MF $0.95 CSCL 20K

An efficient procedure is described for reanalysis of space-truss structural frameworks. The procedure was programmed to operate as a postprocessor to determine response changes from sets of displacements developed for the initial structure by an independent structural analysis system. Examples given show substantial savings in computation time when operating in conjunction with the NASTRAN structural analysis system.

Author

N71-36301*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

CONVERGENCE OF THE NASTRAN PLATE ELEMENTS FOR SHELL STRESS ANALYSIS

Michael T. Wilkinson and Robert E. Fulton *In its* NASTRAN: Users Experiences Sep. 1971 p 749-767 refs (See N71-36253 22-32)

Avail: NTIS HC $9.00/MF $0.95 CSCL 20K

The convergence properties of the QUAD2 element contained in NASTRAN for approximating shell structures were investigated. Application is made to the stress analysis of cylindrical and conical shells, and NASTRAN results are compared with those obtained from classical shell theory. The results converge monotonically to the exact shell theory results as the mesh size is reduced. They also indicate that, for the cylindrical shell, the flat plate approximation has a principal truncation error of the order of the square of the element size.

Author

N71-36302*# North American Rockwell Corp., Downey, Calif.

SPACE SHUTTLE: THE NEED FOR SUBSTRUCTURING

H. R. Grooms and S. Yahata *In* NASA. Langley Res. Center NASTRAN: Users Experiences Sep. 1971 p 769-778 refs (See N71-36253 22-32)

Avail: NTIS HC $9.00/MF $0.95 CSCL 22B

A brief sketch of the method of substructuring is given. The benefits which accrue from using this method of analysis on complex structures such as space shuttles are discussed. Author

N71-36303*# MacNeal-Schwendler Corp., San Marino, Calif.

A DESIGN STUDY FOR THE INCORPORATION OF AEROELASTIC CAPABILITY INTO NASTRAN

Robert L. Harder, Richard H. MacNeal, and Robert V. Doggett, Jr. (NASA. Langley Res. Center) *In* NASA. Langley Res. Center NASTRAN: Users Experiences Sep. 1971 p 779-795 refs (See N71-36253 22-32)

Avail: NTIS HC $9.00/MF $0.95 CSCL 20K

A study to define the modifications required to add aeroelastic capability to the NASTRAN program is summarized. A preliminary design for the capability was developed, including the subdivision of the task into functional modules, the specification of the mathematical content of the modules, and the arrangement of modules into flow diagrams for new NASTRAN rigid formats.

Author

N71-36304*# Boeing Co., Renton, Wash.

SOLID ELEMENT REQUIREMENT FOR NASTRAN

Stig Wahlstrom *In* NASA. Langley Res. Center NASTRAN: Users Experiences Sep. 1971 p 797-811 refs (See N71-36253 22-32)

Avail: NTIS HC $9.00/MF $0.95 CSCL 20K

Coding considerations for implementation of general isoparametric solids into a displacement method analysis program are presented. The user interfaces (input and output) with such a program are discussed. The considerations presented have been or are being implemented into an integrated structural analysis and design program.

Author

N71-36305*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

ON THE REDUCTION OF PROLIFERATION OF FINITE ELEMENT PROGRAMS

T. G. Butler *In its* NASTRAN: Users Experiences Sep. 1971 p 813-825 (See N71-36253 22-32)

Avail: NTIS HC $9.00/MF $0.95 CSCL 20K

It is argued that a sufficient number of good, maintainable finite element programs are in existence today to vitiate against the inauguration of any new programs. Further arguments are presented which attempt to show that the benefits derived from a reduction in proliferation would result in better communication, reduced cost, and increased dissemination of capability. The NASTRAN program is cited as being representative of a good, modular, maintainable program which, if found to be insufficient, can be erighted by directly modifying the offending portion.

J.G.M.

N71-36306# Royal Aircraft Establishment, Farnborough (England).
ESTABLISHING THE RELATIONSHIP BETWEEN THE TRUE STRESS AND THE NECKING OF TENSILE TEST SPECIMENS [DIE ERMITTLUNG DES ZUSAMMENHANGES ZWISCHEN DER WAHREN SPANNUNG UND DER EINSCHNUERUNG AN ZUGPROBEN]
L. Gillemot May 1971 25 p refs Transl. into ENGLISH from Arch. Eisenhuettenw. (Germany), v. 37, no. 7, 1966 p 591-599
(RAE-LIB-TRANS-1587) Avail: NTIS

A relationship to describe the variation of true stress as a function of the degree of deformation is derived. Tensile tests were carried out on aluminium, copper and unalloyed steels with varying carbon contents; the deformation of each test piece was continually filmed. It is shown that the limits of uniform elongation and maximum load do not always coincide, particularly for soft materials such as copper and aluminium. The change in the strain rate in the necked region of a test piece was also measured. Author

N71-36307# Toronto Univ. (Ontario). Institute for Aerospace Studies.
STATIC AND FATIGUE STRENGTH OF FM-123-2 ADHESIVE IN DOUBLE STRAP JOINTS OF VARIOUS LENGTHS OF OVERLAP
V. Niranjan, D. R. Hamel, and C. A. Yang Apr. 1971 40 p refs
(UTIAS-160) Avail: NTIS

Static and fatigue test results on double strap joints of 2024-T3 clad aluminum bonded with FM-123-2 adhesive are presented. The results are statistically analyzed. S-N curves are presented with 95 percent confidence limits. A computer program for the statistical analysis of fatigue results is included. Author

N71-36308# Indian Inst. of Science, Bangalore. Dept. of Aeronautical Engineering.
DESIGN DATA ON BUCKLING OF SIMPLY SUPPORTED SKEW PLATES (OBLIQUE COMPONENTS). PART 2: COMBINED LOADING
Mahabaliraja and S. Durvasula Jul. 1971 95 p refs
(AE-299-S-Pt-2) Avail: NTIS

Design data on buckling under combined loading of simply supported skew plates is presented in the form of tables and interaction curves. The formulation is based on the Rayleigh-Ritz method with deflection expressed as a double Fourier sine series in oblique coordinates. The stresses are expressed in terms of oblique components. Several interesting features associated with buckling under shear loading are discussed. The data presented should prove to be of use in design. Author

N71-36309# Road Research Lab., Crowthorne (England).
CALCULATIONS OF STRESSES, STRAINS AND DISPLACEMENTS IN A LAYERED ELASTIC STRUCTURE, PART 2
E. N. Thrower 1971 29 p
(PB-199214; RRL-LR373) Avail: NTIS CSCL 13M

A computer program based on an earlier analysis, for computing stresses, strains and displacements in an n-layered elastic structure under the action of a number of vertical loads acting on the top surface is presented. Results are computed simultaneously at up to 8 depths along a number of vertical lines, where the product mq may not exceed 40. The positions of the loads and of the points at which results are required can be specified arbitrarily. The stresses, are given both in terms of the components with respect to a chosen set of Cartesian coordinates and in terms of the principal components. The invariants of the stress and strain tensors are also printed. Author (GRA)

N71-36310# California Univ., Livermore. Lawrence Radiation Lab.
TWO-DIMENSIONAL STRESS-INDUCED ADIABATIC FLOW
J. T. Cherry, S. Sack, G. Maenchen, and V. Kransky 30 Dec. 1970 62 p refs
(UCRL-50987) Avail: NTIS

The TENSOR code provides a numerical solution to the propagation of a stress wave of arbitary amplitude through a Lagrangian grid in two space dimensions. The code is described. Author (NSA)

N71-36311# National Physical Lab., Teddington (England). Div. of Numerical and Applied Mathematics.
BENDING AND TORSION OF ANISOTROPIC BEAMS
A. F. Johnson Mar. 1971 50 p refs
(NPL-MA-96) Avail: NTIS

A mathematical formulation of the bending and torsion of an anisotropic elastic beam is given. Approximate analytic solutions to the problem are obtained by variational methods and are shown to agree well with a numerical solution. The results are used to analyze the bending and torsion of a transversely isotropic elastic beam. It is shown that a beam may have a bending stiffness greater than the maximum modulus associated with the material of the beam, a result which is significant for design with composite materials. A sequence of bending and torsion experiments is described from which the five compliances of a transversely isotropic material may be determined. The results are generalized in order to determine the frequency dependent compliances of anisotropic viscoelastic materials. Author (ESRO)

N71-36312# Watervliet Arsenal, N.Y.
THE FORCED MOTION OF A NONCONSERVATIVELY LOADED ELASTIC SYSTEM
Wayne W. Walter Apr. 1971 47 p refs
(AD-726378; WVT-7113) Avail: NTIS CSCL 20/11

The solution of a nonself-adjoint boundary value problem, having both time derivatives of the dependent variable and known time-dependent functions in the boundary conditions, is obtained by means of Williams' method. Because the problem is nonself-adjoint, the usual form of the modified orthogonality condition for the eigenfunctions is no longer applicable, and must be replaced by a modified biorthogonality condition relating the eigenfunctions of the original system to those of its adjoint. Plots of displacement versus time and mode shapes are given. In solving the problem, a heretofore unclear limitation of Williams' method is pointed out. Author (GRA)

N71-36313# Brown Univ., Providence, R.I. Engineering Div.
NORMAL IMPACT OF AN INFINITE ELASTIC-PLASTIC BEAM BY A SEMI-INFINITE ELASTIC ROD Technical Report, Feb. 1970 - Mar. 1971
S. Ranganath and R. J. Clifton Wright-Patterson AFB, Ohio AFML May 1971 71 p refs
(Contract F33615-70-C-1101)
(AD-726846; AFML-TR-71-106) Avail: NTIS CSCL 20/11

Solutions are obtained for the problem of normal impact of an infinite elastic-plastic beam by a semi-infinite elastic rod. The effects of rotatory inertia and shear deformations are included in the equations governing the motion of the beam. A strain rate independent model based on concepts similar to those employed in quasi-static plasticity is used to describe material behavior. The interaction between moment and shear force is included. A strain hardening criterion is used based on the quasi-static moment-curvature relation for pure bending. Strain-time profiles computed using this theory agree reasonably well with those obtained in experiments on aluminum beams. The computed solutions are also compared with predictions based on a rigid perfectly plastic beam theory. Author (GRA)

N71-36314# Bell Aerospace Co., Buffalo, N.Y.
MAGIC 2: AN AUTOMATED GENERAL PURPOSE SYSTEM FOR STRUCTURAL ANALYSIS. VOLUME 1: ENGINEER'S MANUAL (ADDENDUM) Final Report, 2 Dec. 1969 - 2 Dec. 1970

Stephen Jordan Wright-Patterson AFB, Ohio AFFDL May 1971 185 p refs
(Contract F33615-69-C-1241)
(AD-726564; AFFDL-TR-71-1-Vol-1) Avail: NTIS CSCL 20/11

An automated general purpose system for analysis is presented. This system, identified by the acronym 'MAGIC II' for Matrix Analysis via Generative and Interpretive Computations, is an extension of structural analysis capability available in the initial MAGIC System. MAGIC provides a powerful framework for implementation of the finite element analysis technology and provides diversified capability for displacement, stress, vibration and stability analyses. The matrix displacement method of analysis based upon finite element idealization is employed throughout. Ten versatile finite elements are incorporated in the finite element library. These are frame, shear panel, triangular cross-section ring, trapezoidal cross-section ring (and core), toroidal thin shell ring (and shell cap), quadrilateral thin shell and triangular thin shell elements. Additional elements include a frame element, quadrilateral plate and triangular plate elements which can be used for both stress and stability analysis. The finite elements listed include matrices for stiffness, mass, incremental stiffness prestrain load, thermal load, distributed mechanical load and stress. Author (GRA)

N71-36315# Bell Aerospace Co., Buffalo, N.Y.
MAGIC 2: AN AUTOMATED GENERAL PURPOSE SYSTEM FOR STRUCTURAL ANALYSIS. VOLUME 2: USER'S MANUAL Final Report, 2 Dec. 1968 - 1 Dec. 1970
Stephen Jordan and A. Michael Gallo May 1971 588 p refs
(Contract F33615-69-C-1241)
(AD-726565; AFFDL-TR-71-1-Vol-2) Avail: NTIS CSCL 20/11

The report, Volume 2 of the MAGIC 2 system contains systems input and structural input data with examples of the computer output. GRA

N71-36316# Bell Aerospace Co., Buffalo, N.Y.
MAGIC 2: AN AUTOMATED GENERAL PURPOSE SYSTEM FOR STRUCTURAL ANALYSIS. VOLUME 3: PROGRAMMER'S MANUAL Final Report, 2 Dec. 1968 - 2 Dec. 1970
A. Michael Gallo May 1971 568 p
(Contract F33615-69-C-1241)
(AD-726566; AFFDL-TR-71-1-Vol-3) Avail: NTIS CSCL 20/11

The report, Volume 3 of the MAGIC 2 system is the programmer's manual designed to facilitate implementation, operation, modification, and extension of the MAGIC 2 system. GRA

N71-36317# Southampton Univ. (England). Inst. of Sound and Vibration Research.
DYNAMICS OF PERIODICALLY STIFFENED STRUCTURES USING A WAVE APPROACH Summary Report, Oct. 1967 - Feb. 1970
Gautam Sen Gupta Wright-Patterson AFB, Ohio AFML May 1971 260 p refs
(Contract F61052-68-C-0027)
(AD-726570; AFML-TR-71-99) Avail: NTIS CSCL 20/11

Vibrations of beams, plates, periodically-stiffened in one or two directions have been analysed in terms of free flexural wave groups. The normal modes of finite periodic beams, skin-stringer structures and 'doubly-periodic structures' are studied in these terms, utilizing the concept of an equivalent internal restraint. Natural frequencies of finite structures are readily determined from the wave propagation constant curves. Free propagation zones of doubly-periodic structures exhibit a doubly periodic pattern. Theorems relating to the free flexural waves and their propagation constants were developed and relationships with the transfer matrix theory established. Two free wave groups have been identified for rib-skin structures and an infinite number for orthogonally stiffened plates. A knowledge of the wave velocity is useful in understanding the mechanism of acoustic coincidence excitation of these structures. Both free and forced plane wave propagation across the plate have been studied, the direction of propagation being varied. Author (GRA)

N71-36318# Brown Univ., Providence, R.I. Div. of Engineering.
OPTIMALITY CRITERIA IN STRUCTURAL DESIGN Technical Report, Jun. 1969 - Nov. 1970
William Prager and Pedro V. Marcal Wright-Patterson AFB, Ohio AFFDL May 1971 129 p refs
(Contract F33615-69-C-1826)
(AD-726551; AFFDL-TR-70-166) Avail: NTIS CSCL 13/13

The principal aim of the present work was to apply suitably generalized principles and methods of structural analysis to problems of structural synthesis. A number of problems of modest size were solved to illustrate the principles and methods that were considered. These problems involved various structural forms (rods, trusses, beams, disks) and loading conditions of static, dynamic, or thermal type. As much of the literature on optimal structural design is concerned with stress constraints, compliance and displacement constraints were emphasized in the present work. Minimum cross-section constraints were also considered, because these constraints guard against the undesirable dropping out of individual elements of the structure and are therefore essential for the application of finite element techniques and hence the extension of the methods described here to complex structures. Methods found to allow efficient optimal design were: the principle of minimum strain energy, a procedure to study the dependence of the optimal design of a structure on the prescribed compliances, and the principle of stationary mutual potential energy. Author (GRA)

N71-36319# Air Force Systems Command, Wright- Patterson AFB, Ohio. Foreign Technology Div.
VARIABLE MODULAR ELASTICITY THEORY OF AN ANISOTROPIC BODY SUBJECTED TO A PLANE STRESSED STATE
N. G. Isabekyan et al 8 Mar. 1971 17 p refs Transl. into ENGLISH from Izv. Akad. Nauk Arm. SSR (USSR), v. 22, no. 5, 1969 p 25-34
(AD-726600; FTD-HC-23-678-70) Avail: NTIS CSCL 20/11

The basic equations and relationships of the variable modular elasticity theory of an anisotropic body subjected to a plane stressed state were given in another article. In a certain sense this article is a supplement to that other article. Here the authors have found the dependences between the coefficients of elasticity for which this body is in fact elastic, i.e., the specific elementary energy of the internal forces is a total differential. The expression is given for the specific potential energy strain. In conclusion the authors also prove the validity of the Castigliano theorem for this anisotropic variable modular material. Author (GRA)

N71-36320# Syracuse Univ., N.Y. Dept. of Chemical Engineering and Materials Science
CALCULATIONS ON THE EFFECT OF THE STRESS STATE ON THE FRACTURE DUCTILITY OF SOLIDS Interim Technical Report
V. Weiss, H. H. Lin, M. Sengupta, and D. Lal Jun. 1971 56 p refs
(Contract N00019-71-C-0102)
(AD-726443; MTS-VW-1915-IT671) Avail: NTIS CSCL 11/6

The report contains the results of calculations on the effect of multiaxial stress states on the fracture ductility of solids. It is assumed that the solids in question follow a stress-strain law of the type sigma = K epsilon to the nth power which holds both for the tensile case as well as for the case of effective stresses and strains. The multiaxiality of the stress state is expressed in the form of ratios, alpha = sigma sub 2/sigma sub 1 and beta = sigma sub 3/sigma sub 1. The fracture ductilities are given in terms of ductility ratios, namely the fracture ductility for a given stress state epsilon sub F, alpha beta divided by epsilon sub TF, the tensile fracture ductility. The results are presented in the form of graphs with the fracture strain ratio as the ordinate, the

stress ratio alpha as the alpha as the abscissa, the stress ratio, beta, and the strain hardening exponent n as parameters. Marin postulated a maximum fracture stress failure criterion. The calculations that were made in accordance with Marin's criterion are labeled maximum stress criterion. Experimental studies have shown that the results are not in good agreement with this criterion. Therefore, Weiss has suggested a failure criterion based on a critical volume strain. In the calculations this criterion enters as a critical mean stress criterion. Author (GRA)

N71-36321# South Dakota State Univ., Brookings. Dept. of Mechanical Engineering.
EFFECT OF DUCTILE AND VISCOUS DISSIPATION ON FRACTURE OF SOLIDS. PART 1: PLASTIC STRESS AND STRAIN FIELDS NEAR CRACK TIP. PART 2: COMPUTER SIMULATION OF FRACTURE SPREADING IN A VISCOELASTIC SOLID Annual Progress Report
Michael P. Wnuk Aug. 1971 40 p refs
(Contract N00014-70-C-0077)
(AD-726745; SDSU-71-04) Avail: NTIS CSCL 20/11

Effect of small scale yielding occuring prior to fracture is discussed in terms of stress and strain fields existing in the immediate vicinity of crack tip. The deformation theory of plasticity is employed. Although the solution is incomplete since it does not provide the shape of the plastic zone, it generates some useful correlations between fracture toughness and other metalurgical parameters, like yield strength, ductility, strain hardening exponent and the grain size. In the second part a governing equation of motion, which describes early stages of fracture in a rate-sensitive solid, has been integrated through the use of an analog computer type EDI 380. Three regimes of the tensile pulsating loading, for which there are no closed form solutions, are considered: sinusoidal load, trapezoidal load and randomly oscillating load. Author (GRA)

N71-36322# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
DAMPING ADDITIONS FOR PLATES USING CONSTRAINED VISCOELASTIC LAYERS
Peter J. Torvik and Daniel Z. Strickland May 1971 40 p refs
(AD-727027; AFIT-TR-71-2; AU-2-71-AFIT-ENB) Avail: NTIS CSCL 20/11

An analysis is given for a damping addition employing several thin viscoelastic sheets and thin metallic layers. The damping layers are alternated with the constraining layers, which are segmented and are not anchored to the base plate. The effectiveness of such additions in increasing the damping of thin simply supported square plates is evaluated and methods for optimizing the design are considered. An experimental investigation of the effectiveness of such damping additions is also reported. Additions weighing a few per cent of the weight of the base plate were found to produce substantial increases in the damping of the system. A non-optimal design was found to produce less, but still substantial damping. Two other damping additions were constructed and tested. These, which employ multiple layers with constraining layers anchored to the base plate, were not optimized, but did produce significant damping. Author (GRA)

N71-36323# Battelle Memorial Inst., Columbus, Ohio.
ANALYSIS AND CHARACTERIZATION OF MATERIALS SUITABLE FOR AIRCRAFT STRUCTURE Final Report, Nov. 1966 - Apr. 1970
William M. Henry, Ellsworth R. Bloeser, Donald K. Landstorm, and Richard E. Heffelfinger Jan. 1971 30 p refs
(Contract F33615-67-C-1166)
(AD-727017; ARL-71-0014) Avail: NTIS CSCL 14/2

The report provides descriptions and discussion of the analytical methodologies used most extensively during 4 years of chemical and structural analysis effort carried out in cooperation with the materials research program of Aerospace Research Laboratories. Author (GRA)

N71-36324 Wisconsin Univ., Madison.
ANALYSIS OF SOME ELASTIC STRESS CONCENTRATION PROBLEMS IN FIBER REINFORCED MATERIALS
Stanley John Russell (Ph.D. Thesis) 1969 86 p
Avail: Univ. Microfilms Order No. 70-3686

A mathematical model is studied for a cracked fiber in which both fiber and surrounding matrix are assumed to be linear elastic materials and bonding at the interface is assumed to be perfect. The mathematical problem is reduced to the solution of a singular integral equation which is treated by a combination of the Weiner-Hopf technique and general approximate methods to establish existence and uniqueness of solution within a physically meaningful class of functions. A convenient representation of solution is also achieved. The solution to the integral equation is related to the nature of stress concentration in the neighborhood of the fiber crack. Numerical results are reported for one selected set of elastic parameter values. Some related simplified mathematical models are discussed. Dissert Abstr.

N71-36325 Illinois Inst. of Tech., Chicago.
ELASTIC/PLASTIC TORSION OF DOUBLY-CONNECTED CYLINDERS
Ray Bernard Stout (Ph.D. Thesis) 1970 124 p
Avail: Univ. Microfilms Order No. 70-17258

Both general theory and numerical results are presented for the elastic/perfectly plastic torsional problem. The general properties of the stress function psi for a doubly-connected domain are treated. It is shown that psi must be a continuously differentiable function, that its time derivative must be continuously differentiable except that a discontinuity may develop across an elastic-plastic boundary. It is shown that after the instant at which psi attains its maximum value on the inner boundary, no plastic region can continue on the lower roof attached to that boundary. It is conjectured that plastic domains form only on roofs. Some theorems which partially support the conjectures are proved. A finite difference numerical procedure for the solution is described and several examples are presented, none of which contradict the conjecture. Dissert. Abstr.

N71-36326 Yale Univ., New Haven, Conn.
SPHERICAL WAVE PROPAGATION IN RATE DEPENDENT MEDIA
Michael P. Zabinski (Ph.D. Thesis) 1969 148 p
Avail: Univ. Microfilms Order No. 70-17231

An infinite medium with a spherical cavity is considered. A radial impact load is suddenly applied uniformly on the surface area of the cavity. Due to the restriction of spherical symmetry and isotropy, at the instant of impact a pulse travels outwards in the form of a spherical wave thus setting up a transient process. The material is assumed to be elastic/viscoplastic with an overstress type constitutive equation. Loading/unloading criteria are established, and the problems of continuous loading, sudden unloading, and gradual unloading are investigated. The method of solution is numerical along characteristics in the radius-time space. The important physical effects governing spherical wave propagation are identified as the level of strain hardening, the viscosity, and the magnitude and duration of impact. Dissert. Abstr.

N71-36327 Georgia Inst. of Tech., Atlanta.
FREE OSCILLATIONS OF THIN-WALLED OPEN SECTION CIRCULAR RINGS
Notley Roger Maddox (Ph.D. Thesis) 1970 166 p
Avail: Univ. Microfilms Order No. 70-18458

A theoretical study of the eigenfrequencies for a complete thin-walled open-section circular ring with one plane of symmetry in the plane of the ring is conducted. A conventional analysis is presented incorporating St. Venant torsion, Timoshenko warping, torsional inertia, and the shear center eccentricity from the center of gravity for out-of plane free oscillations and extensionality for in-plane free oscillation. A higher order theory of free oscillations derived from Novozhilov's

thin shell theory by restricting the toroidal shell's cross-section so that it deforms as a rigid body in the plane of the cross-section but is free to warp out of that same plane is investigated. It is concluded that the conventional theory incorporating the shear center eccentricity is adequate to describe the first few eigenfrequencies of a complete monosymmetric ring with a radii ratio in the neighborhood of 1 to 50. Dissert. Abstr.

N71-36328 State Univ. of New York At Buffalo.
PARAMETRIC STABILITY OF THIN CYLINDRICAL SHELLS IN NONSTATIONARY TEMPERATURE FIELDS
Dah-Sheng Fine (Ph.D. Thesis) 1969 72 p
Avail: Univ. Microfilms Order No. 70-17321

A study of stability subjected to periodic axial loads in a time-dependent temperature field is presented. It is assumed that the mechanical characteristics of the material of the shell depend on the temperature. The shell material is considered to be elastic. A nonlinear shallow shell theory is adopted, where only the deflection in the normal direction is considered large. The conditions for the existence of periodic solutions of nonlinear differential equations are established. The principal regions of stability for the shells are constructed with the unstable solutions shown in the resonance curve. Futhermore, boundary frequencies of the principal parametric resonances are obtained. The solution developed may be applied to multilayer anisotropic shells, noncircular cylindrical shells, and shells of variable thickness.
Dissert Abstr.

N71-36329 State Univ. of New York At Buffalo.
DYNAMIC RESPONSE OF PLATES AND SHALLOW SHELLS OF RECTANGULAR PLANFORM
Yu-Chung Lee (Ph.D. Thesis) 1969 145 p
Avail: Univ. Microfilms Order No. 70-17345

Solutions are presented for the dynamic response of a simply supported rectangular plate and a shallow shell of rectangular planform. The plate is treated within the framework of three different mathematical models: (a) classical plate theory, (b) improved plate theory which includes the effects of shear deformation and rotatory inertia, and (c) classical, three dimensional elasticity theory. The shallow shell is treated within the frameworks of the elementary theory (combined membrane and bending effects), and the improved theory. The load imposed on both plate and shell is a suddenly applied, uniformly distributed transverse pressure over a rectangular area, the sides of which are parallel and perpendicular to the sides of the rectangular planform. Exact solutions in series form are given, and detailed comparisons for the different theories are presented.
Dissert. Abstr.

N71-36330 Illinois Inst. of Tech., Chicago.
DISCREPANCIES IN MINIMUM VOLUME DESIGNS UNDER THE TRESCA AND MISES YIELD CRITERIA
Harbans Singh Sidhu (Ph.D. Thesis) 1970 67 p
Avail: Univ. Microfilms Order No. 70-17257

A unified treatment of the Tresca and the Mises yield loci, as presented here, brings out the similarities and the differences in the behavior of the two criteria. Particular reference is made to the fact that the designer can no longer select a yield criterion from the point of view of mathematical convenience alone. The distribution of the material as well as the number and location of design constraints in a minimum volume design depend upon the selection of the yield locus. The type of discrepancies discussed occur only in shells and not in plates. A number of theorems are established which bring out the fundamental properties of minimum volume design. Dissert. Abstr.

N71-36331 Iowa State Univ. of Science and Technology, Ames.
WAVES OF SMALL BUT FINITE AMPLITUDE: ASYMPTOTIC THEORY
Alexander Sedov (Ph.D. Thesis) 1970 164 p
Avail: Univ. Microfilms Order No. 70-18905

An expansion procedure is developed that enables the study of the effects of dissipative and dispersive mechanisms and of nonlinearity on a linear wave propagating in a general continuum. A similarity hypothesis is used that relates all of the interacting effects of dissipation, dispersion and nonlinearity to a single inner parameter, interpreted as the reciprocal of Reynolds number. The far-field asymptotic structure equation brings out the effects of curvature, nonlinearity, dissipation and dispersion. The equation generalizes to higher dimensions earlier results obtained in reference to dispersive water waves and to dissipative waves in gases. Dissert. Abstr.

N71-36332 Rensselaer Polytechnic Inst., Troy, N.Y.
FATIGUE BEHAVIOR OF THIN SOLID FILMS INDUCED BY A MOVING SURFACE LOAD
Richard Anthony Mollicone (Ph.D. Thesis) 1970 54 p
Avail: Univ. Microfilms Order No. 70-19946

A test device was designed to subject coated specimens to moving normal loads of specific values. Various types of indium films were used. Separation of particles from the substrate and from the coating itself were noted in all cases where failure occurred. Times to failure were analyzed statistically and plotted. Experimental results agree with conclusions of the theoretical analysis. The data plots for indium coatings appear to indicate a fatigue behavior following the standard format for this type failure. Although no results are obtained from the other coatings chosen, there is sufficient reason to believe that thin films do exhibit fatigue under the type of loading described.
Dissert. Abstr.

N71-36333 California Univ., Berkeley.
AXISYMMETRIC WAVES IN TRANSVERSELY ISOTROPIC RODS
Yalcin Mengi (Ph.D. Thesis) 1969 105 p
Avail: Univ. Microfilms Order No. 70-17621

Axisymmetric wave propagation in a transversely isotropic rod is studied. First, using three dimensional elasticity theory wave propagation in an infinitely long, transversely isotropic rod is examined and the frequency equation is established. The information obtained from the exact frequency equation is used to build a three-mode approximate theory which accommodates geometrical dispersion in the rod for a sufficiently large range of frequencies. Classical one dimensional theory and that with radial inertia correction are also obtained. Employing the method of characteristics, the governing equations of three-mode theory are solved for a semi-infinite rod which is initially at rest and subjected to a time dependent uniform pressure on its end. Numerical results for radial, axial strains and axial force are obtained when the input has a step distribution in time. For the three-mode theory the orthogonality conditions of mode shapes of free vibrations and conditions for uniqueness are also established. Dissert. Abstr.

N71-36334 Wisconsin Univ., Madison.
THE DYNAMIC RESPONSE OF THIN CYLINDRICAL SHELLS UNDER INITIAL STRESSES AND SUBJECTED TO GENERAL THREE DIMENSIONAL SURFACE LOADS
Nan-Kang Liao (Ph.D. Thesis) 1970 161 p
Avail: Univ. Microfilms Order No. 70-13925

A general solution for the displacements of the mid-surface of a thin circular cylindrical shell, simply supported at both ends, of finite length, under an initial state of stresses and subjected to general time dependent surface loads is presented. The Galerkin method together with the Laplace transform approach has been employed in formulating the solutions to the problems based on both Flugge's and Donnell's theories. The results are presented in integral forms for the time dependent coefficients of the double series representation of coordinate functions which define the mode shapes of vibration. These results may be used to evaluate the response of the shell for any arbitrary time dependent surface load. Dissert. Abstr.

N71-36335 Purdue Univ., Lafayette, Ind.
A STUDY OF RELATIVISTIC CONSTITUTIVE EQUATIONS OF CONTINUA
Howard Duane Curtis (Ph.D. Thesis) 1970 208 p
Avail: Univ. Microfilms Order No. 70-18822

The constitutive equations of simple materials with electromagnetic as well as thermal and mechanical memory were studied from a relativistic viewpoint. A relativistic principle of material objectivity is extended and explored in detail. This principle (nonsentient response) is applied together with the relativistic Second Law of Thermodynamics to systematically obtain reduced forms of those quite general constitutive relations initially assumed herein. An example is provided to illustrate the application of the theory. Dissert. Abstr.

N71-36336 State Univ. of New York At Buffalo.
RANDOM-PARAMETER ANALYSIS OF THE STABILITY OF INELASTIC STRUCTURES
Bertrand Tze-King Chung (Ph.D. Thesis) 1969 90 p
Avail: Univ. Microfilms Order No. 70-17314

The development of statistical models for the buckling of inelastic structures is discussed by considering the material properties as random parameters whose joint probability density function is known. Two specific examples are explored, the inelastic buckling of centrally loaded H-column with residual stresses and a problem of inelastic buckling of plates with residual stresses. In both problems Young's modulus, the yield stress level, and the maximum compressive residual stress are considered to be the random variables. The statistical solutions obtained are in the form of probability distribution functions. In both problems numerical results are compared with the corresponding deterministic solutions. The comparisons show clearly that solutions based on statistical models are more rational than those obtained by deterministic analysis from a designer's viewpoint. Dissert. Abstr.

N71-36337 Wisconsin Univ., Madison.
VIBRATIONS OF SPHERICAL SHELLS IN WATER
Feng-Chih Chen (Ph.D. Thesis) 1970 108 p
Avail: Univ. Microfilms Order No. 70-13907

Free vibrations and harmonic and aperiodic forced vibrations of elastic spherical thin shells in water are investigated. By applying Hamilton's principle a pair of basic coupled equations of motion is derived based on the bending theory. For harmonic motions these equations are combined into a single sixth-order nonhomogeneous differential equation of motion in normal displacement. For a shell vibrating in water, the displacement of the shell and the hydrodynamic pressure of the water field form an interaction problem which characterizes all vibration problems of underwater structures and is solved by introducing the velocity potential of the water field. For the vibrations of a complete spherical shell in water, the frequency equation is derived, the mode shapes are obtained and the general expressions of the responses due to harmonic and aperiodic force excitations are derived. For the free vibrations of a hemispherical shell with its open edge fixed at the bottom of the sea, the transcendental frequency equation is obtained and the mode shapes are studied. Dissert. Abstr.

N71-36338 Nebraska Univ., Lincoln.
FINITE ELEMENT ANALYSIS OF AXISYMMETRICAL SHELLS OF COMPOSITE MATERIAL
Ved Prakash Chaudhary (Ph.D. Thesis) 1970 142 p
Avail: Univ. Microfilms Order No. 70-17712

A doubly curved surface of revolution element was developed for the direct stiffness analysis of axisymmetrical shells of composite material. The assumptions of classical shell theories regarding preservation of the normal and thickness to radius ratio were abandoned in the development of the stiffness matrix. Thickness, temperature, material properties, and load intensity are allowed to vary along the generator of the shell; material properties may vary through the thickness. A digital computer program was written to accomplish the computations. In the program, the shape of the shell is described by point-by-point numerical values; thus the generator can be of quite general shape and the element can take on the shape of the shell without the usual approximations. Numerical results show close correlation with known solutions of a number of isotropic shells and with experimental data of a hydrostatically tested composite material shell. Dissert. Abstr.

N71-36339 Georgia Inst. of Tech., Atlanta.
LONGITUDINALLY EXCITED NONLINEAR LIQUID MOTION IN A CIRCULAR CYLINDRICAL TANK WITH ELASTIC BOTTOM
Shen-shu Chang (Ph.D. Thesis) 1969 120 p
Avail: Univ. Microfilms Order No. 70-17967

A theoretical investigation of liquid motion in a circular cylindrical container subjected to longitudinal excitation of sinusoidal form is presented. The basic equations are derived for an incompressible and nonviscous liquid. The motion of the liquid is considered to be irrotational. The container bottom is treated as a thin elastic plate, while the dynamic and kinematic conditions of the liquid free surface are represented by nonlinear equations. Depending on the excitation parameters, the free surface will exhibit a plane surface or oscillate with a finite amplitude. The finite amplitude can be a one-half subharmonic, harmonic, or superharmonic of the excitation frequency. Both one-half subharmonic responses have been treated in more detail. A comparison of the responses of the liquid in a container with an elastic bottom as well as a rigid bottom was made. The free surface elevations and the forces and moments due the liquid motions were obtained also. Dissert. Abstr.

N71-36340 Ohio State Univ., Columbus.
GENERAL THEORY OF HETEROGENEOUS ELASTIC PLATES
Girish Kumar Agrawal (Ph.D. Thesis) 1970 182 p
Avail: Univ. Microfilms Order No. 70-19287

Using the basic assumptions of thin plate theory, a general dynamic theory of anisotropic heterogeneous elastic plates (which can have heterogeneity in the x,y,z directions) incorporating the large deflection assumptions of von Karman has been developed from the three-dimensional theory of elasticity. Transverse shear deformations, inertia terms and thermal effects are also included. The resulting equations consisting of a tenth order system of nonlinear, coupled partial differential equations with variable coefficients and the corresponding five boundary conditions are derived from variational principles. A simplified eighth order heterogeneous plate theory based upon the Kirchhoff assumptions has also been established and correspondingly, four boundary conditions are formulated. Dissert. Abstr.

N71-36341 Ohio State Univ., Columbus.
STRESSES AND DEFORMATIONS IN MULTIPLY BIAS PNEUMATIC TIRES SUBJECT TO INFLATION PRESSURE LOADING
Howell Keith Brewer (Ph.D. Thesis) 1970 211 p
Avail: Univ. Microfilms Order No. 70-18297

The pneumatic tire casing is treated as a laminated, anisotropic, toroidal shell of revolution possessing bending rigidity. The plies are considered to be homogeneous orthotropic laminae on a macroscopic scale, which are constructed of elastic textile cords embedded in an elastic rubber matrix. Modern micro-mechanics theory is used to calculate the four basic elastic moduli of a single lamina. In this theory the textile cord is treated as a transversely isotropic fiber while the rubber matrix is considered to be simply isotropic. The cord angle variations are taken into account by allowing the anisotropy of the tire shell to vary with the meridian position. In addition the exact meridian profile of the tire carcass is used as opposed to circular or elliptical profiles used by some investigators to simplify the analysis. Dissert. Abstr.

N71-36342 Virginia Polytechnic Inst., Blacksburg.
CHARACTERIZATION OF POLYCARBONATE AS A PHOTOELASTO-PLASTIC MATERIAL
John Kerr Whitfield (Ph.D. Thesis) 1970 104 p
Avail: Univ. Microfilms Order No. 70-19193

A controlled strain apparatus capable of performing the tests essential to establishing the yield locus of polycarbonate was designed and built. Material characterization tests were performed in the form of uniaxial strain rate, creep, isotropy, isoclinic, and reloading tests. The yield locus for polycarbonate was determined and an analytical expression was developed, capable of transforming polycarbonate data to the Mises circle. Yield locus results indicate that although polycarbonate is not a Mises material the yield locus may be approximated by a circle over a substantial range of Lode's variable. Tests were run on large plates with holes. Excellent correlation with two-dimensional theory was obtained in the elastic zone and in the plastic zone where local thickness changes were small. Substantial divergence between theory and experiment occurred in the plastic zone where thickness changes were large.
Dissert Abstr.

N71-36343 Purdue Univ., Lafayette, Ind.
VIBRATION ANALYSIS OF SHELL STRUCTURES USING RECEPTANCES
Lynn Le Roy Faulkner (Ph.D. Thesis) 1969 138 p
Avail: Univ. Microfilms Order No. 70-8887

An analytical method of predicting the mode shapes and natural frequencies of vibration for combined continuous structures is investigated. The technique consists of formulating edge receptances for classical geometric shapes and analyzing complete structures by matching receptances at the boundaries of the elements. Three typical engineering structures are considered: a simply supported circular cylindrical shell with a stiffening ring, a circular cylindrical shell closed by circular end plates, and a circular cylindrical shell with end plates and a stiffening ring. The solution method is used to predict natural frequencies and mode patterns for three actual physical systems. Experimental data supporting the theory is given. Some experimental findings not reported by other investigators are also presented.
Dissert. Abstr.

33 THERMODYNAMICS AND COMBUSTION

Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants.

N71-36344*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
AERODYNAMIC HEATING OF A SPACE SHUTTLE DELTA-WING ORBITER
William K. Lockman and Charles E. DeRose Aug. 1971 81 p refs
(NASA-TM-X-62057) Avail: NTIS CSCL 20M

An experimental investigation was performed to obtain detailed aerodynamic heating distributions on a model of the orbiter with twin wing-tip vertical tails. Test data were obtained for an angle-of-attack range of -5 deg to 53 deg, selected sideslip and control surface deflection angles, a free-stream Mach number of 7.4, and free stream Reynolds numbers, based on model body length, from 1 million to 7 million. Results showing the effects of Reynolds number, vehicle attitude, and control surface deflections on the vehicle heating are presented and analyzed.
Author

N71-36345*# Stanford Research Inst., Menlo Park, Calif.
INDUCTION PLASMA CALCINING OF PIGMENT PARTICLES FOR THERMAL CONTROL COATINGS
Interim Technical Report, 1 Feb. - 31 Jul. 1971
E. P. Farley 2 Aug. 1971 17 p refs
(Contract NAS8-21270)
(NASA-CR-119931; ITR-5) Avail: NTIS CSCL 20M

The potential of employing induction plasma heating techniques for calcining pigment particles used in thermal control coatings is investigated. Fine particles of silicated zinc oxide and zinc orthotitanate were dispersed in a carrier gas of argon and oxygen and were heated by hot argon produced in an induction plasma. Plasma treating of two additional surface-treated zinc orthotitanate powders at 1670 proved this to be an optimum temperature for plasma calcining zinc orthotitanate. The effect of increasing the amount of Zn_2TiO_4 powder produced to a rate of 5 lb per 8-hr. shift was also investigated.
Author

N71-36346*# General Electric Co., Philadelphia, Pa. Space Systems Organization.
A JOINT HEAT TRANSFER DATA CRITICAL STUDY AND DESIGN GUIDELINES Final Report
E. Fried 7 Jun. 1971 95 p refs Revised
(Contract NAS8-26490)
(NASA-CR-119933; Doc-71SD4241) Avail: NTIS CSCL 20M

Results are presented of a study undertaken to: (1) review existing information on the prediction of bolted joint heat transfer; and (2) select and recommend guidelines and procedures to enable the thermal design engineer to predict, within reasonable limits, such joint heat transfer for spacecraft applications. Included are tables and graphs showing experimental data on bolted joints and related data. A glossary of terms is also provided. Empirical approaches were used exclusively because analytical methods are not sufficiently developed to allow for reliable predictions of the load distribution in the joint or the area of apparent and real contact.
A.L.

N71-36347*# Stanford Univ., Calif. Thermosciences Div.
HEAT TRANSFER TO THE TRANSPIRED TURBULENT BOUNDARY LAYER
W. M. Kays Jun. 1971 59 p refs
(Grants NGL-05-020-134; NSF GK-2201)
(NASA-CR-120791; HMT-14) Avail: NTIS CSCL 20M

A summarization of an investigation on heat transfer to the transpired turbulent boundary layer is presented. The experimental results are presented for friction coefficient and Stanton number over a wide range of blowing and suction for the case of constant free-stream velocity, holding constant certain blowing parameters. The problem of the accelerated turbulent boundary layer with transpiration is considered, experimental data are presented and discussed, and theoretical models for solution of the momentum equation under these conditions are presented. Data on turbulent Prandtl number are presented so that solutions to the energy equation may be obtained. Some examples of boundary layer heat transfer and friction coefficient are presented using one of the models discussed, employing a finite difference solution method.
Author

N71-36348*# ITT Aerospace/Optical Div., Fort Wayne, Ind. Electro-Optical Operations.
CONSTRUCTION AND TEST OF A DUAL PATCH MULTI-ELEMENT RADIANT COOLER Final Report, 17 Sep. 1970 - 30 Jun 1971
R. V. Annable and J. F. Lodder Jun. 1971 157 p
(Contract NAS5-21132)
(NASA-CR-121854) Avail: NTIS CSCL 20M

The construction and tests conducted on the dual patch multi-element radiant cooler are described. During the tests, the patch temperatures were 112 K and 95 K for the InAs and HgCdTe arrays, respectively. A change in design was needed to obtain the second temperature. Cooler and other tests showed that the multilayer blankets had insulation factors from 80 to 85 and that the effective cone wall emissivity was about 0.44.

Other measurements confirmed the theoretical predictions on the radiative decoupling between low emissivity surfaces. Supporting studies revealed the need for optically finished cone walls. They also showed that orbital operating time is limited by contamination from the spacecraft atmosphere. Improvements in the space target and additional measurements on the cone walls are needed to improve testing accuracy. Author

N71-36349# Atomic Energy Commission Research Establishment, Lucas Heights (Australia).
HEAT PIPES AND THEIR APPLICATIONS: A BIBLIOGRAPHY
Jean Geue, comp. Jan. 1971 17 p refs
(AAEC/LIB/Bib-264) Avail: AEC Depository Libraries

Ninety-seven references are listed. They are arranged chronologically by year, covering the period 1964 to 1970, and alphabetically by author within each year. Most references are to general engineering and heat transfer studies, but a percentage involves heat pipes in nuclear systems. Reference is made to an abstract from each article. NSA

N71-36350*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THE MEASUREMENT OF CAPSULE HEAT TRANSFER GAPS USING NEUTRON RADIOGRAPHY
Lawrence A. Thaler 1971 22 p refs Presented at Winter Meeting of the Am. Nucl. Soc., Miami Beach, Fla., 17-21 Oct. 1971
(NASA-TM-X-67920; E-6552) Avail: NTIS CSCL 20M

The use of neutron radiographs to determine dimensional changes of heat transfer gaps in cylindrical nuclear fueled capsules is described. A method was developed which involves scanning a very fine grained neutron radiograph negative with a recording microdensitometer. The output of the densitometer is recorded on graph paper and the heat transfer gap is plotted as a well defined optical density change. Calibration of the recording microdensitometer ratio arms permits measurements to be made of the heat transfer optical density change from the microdensitometer trace. Total heat transfer gaps, measured by this method, agree with the physical measurements within + or - 0.005 cm. Author

N71-36351*# Rice Univ., Houston, Tex.
A FUNDAMENTAL STUDY OF SUBLIMATION THROUGH A POROUS SURFACE Final Report
Alan J. Chapman 30 Jul. 1971 134 p refs
(Contract NAS9-7969)
(NASA-CR-115153) Avail: NTIS CSCL 20M

The principal modes of operation for a porous plate sublimator-evaporator are defined and analyzed. This includes analysis of the sublimation mode, evaporation mode, mixed mode, and a newly hypothesized cyclic sublimation mode. The physical properties which govern the operation of each mode are investigated, and analytical expressions are derived to allow prediction of operating modes and temperatures. These equations are derived by relating the heat and mass flow relations. For the mass flow through the porous plate to be expressed explicitly, simplifying assumptions were made concerning the porous structure of the porous plate. The plate is assumed to consist of a known number of pores of known size. Because of the pressure and temperature range involved and the small size of the pores, the flow through the porous plate is in the free molecular regime. Author

N71-36352*# Pennsylvania State Univ., University Park. Mechanical Engineering Dept.
HYBRID AND DECOMPOSITION COMBUSTION OF THE HYDRAZINE FUELS
C. B. Allison Jul. 1971 101 p refs
(Grant NGR-39-009-077)
(NASA-CR-72977) Avail: NTIS CSCL 21B

The combustion characteristics of the hydrazine fuels (N2H4, MMH, and UDMH) were studied for both oxidation (hybrid combustion) and decomposition conditions. A flat flame burner was used to provide the high temperature gaseous environment for burning drops of liquid fuel at atmospheric pressure. The burner provided a temperature range of 1660 K to 2530 K and an ambient oxygen mass fraction range of 0.0 to 0.42. In addition, a wide range of drop sizes (0.11 cm to 1.91 cm) were considered by employing both the porous sphere and suspended droplet experimental techniques. It was found that the burning rates of all three fuels increased with increasing drop diameter, ambient temperature, and ambient oxygen concentration. To aid in correlating the data obtained, a theoretical hybrid combustion model was developed. The average error between predicted burning rates using the model and measured burning rates was less than 20% for all three fuels. Author

N71-36363*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
WINDWARD SURFACE HEATING ON THE MSC ORBITER FUSELAGE
George G. Mateer Aug. 1971 46 p refs
(NASA-TM-X-62051) Avail: NTIS CSCL 20M

Heat transfer data were obtained on the windward surface of the Manned Spacecraft Center orbiter fuselage (without wings) at a freestream Mach number of 7.4 and angles of attack from 40 to 70 deg. Heating and transition data were compared with appropriate theories and correlations, and some effects of surface roughness were simulated. Conclusions of the study are: (1) Laminar heating is predictable by simple, modified-swept-cylinder theory. (2) Initial boundary-layer transition correlations proposed for the shuttle are somewhat conservative for the present data. (3) Surface roughness was sufficient to cause premature transition and local increases of 20% in transitional and turbulent heating rates. Author

N71-36364*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
AERODYNAMIC HEATING OF A SPACE SHUTTLE DELTA-WING BOOSTER AT FREE STREAM MACH 7.4
Charles E. DeRose and William K. Lockman Aug. 1971 68 p refs
(NASA-TM-X-62058) Avail: NTIS CSCL 20M

Test results were obtained for an angle-of-attack range from -5 deg to 60 deg at a free-stream Mach number of 7.4 and free-stream Reynolds numbers, based on model reference length (distance from nose to base of delta wing), from 1 to 5 million. Results showing the effect of Reynolds number and vehicle attitude on the vehicle heating are presented and discussed. Author

N71-36368*# Dynatherm Corp., Cockeysville, Md.
DESIGN AND DEVELOPMENT OF A PROTOTYPE STATIC CRYOGENIC HEAT TRANSFER SYSTEM Final Report
Aug. 1971 88 p refs
(Contract NAS8-21191)
(NASA-CR-121939; DTM-50-5D) Avail: NTIS CSCL 20M

An analysis was conducted which verified the high performance capability of a nonwetting cryogenic capillary-pumped-loop. As a result, an investigation was undertaken to determine the feasibility of obtaining a nonwetting cryogenic liquid/solid combination. Results of a literature search indicated that this was feasible for cryogenic liquids provided that low energy solid surfaces are used. Contact angle measurements of liquid nitrogen, oxygen, and Freon 13 on various low energy surfaces were made. The results of these measurements showed that all of the test samples were wet by the different cryogenic liquids; the highest contact angle measured was 30 deg. However, for a high-performance static cryogenic heat transfer system the development of a heat pipe which utilized a wetting arterial wick was pursued. An experimental model whose artery design was optimized to facilitate start-up was fabricated and tested. Nitrogen was used as the working fluid. The experimental model has a heat transport capability greater than 1500 watt-cm

which is well in excess of projected requirements for spacecraft applications employing cryogenic heat pipes. Author

N71-36358*# Translation Consultants, Ltd., Arlington, Va.
THE BEHAVIOR OF A BURNING CANDLE IN GRAVITATIONLESS SPACE [DAS VERHALTEN EINER BRENNENDEN KERZE IM SCHWEREFREIEN RAUM]
A. Faessler Washington NASA Sep. 1971 10 p refs Transl. into ENGLISH from Naturwissenschaften (W. Berlin), v. 51, no. 23, 1964 p 545-547
(Contract NASw-2038)
(NASA-TT-F-13940) Avail: NTIS CSCL 21B

The credibility of the experiments conducted by Clusius on the expiration of a flame during free fall is questioned. Two experimental arrangements are described which eliminate the effect of the continued air circulation due to inertia. A procedure is suggested for performing the experiment with a wickless flame. J.G.M.

N71-36357# Bureau of Mines, Amarillo, Tex. Helium Research Center.
VAPOR-LIQUID EQUILIBRIA DATA FOR THE HELIUM NITROGEN SYSTEM AS PREDICTED BY THE VAN DER WAALS EQUATION OF STATE
B. J. Dalton and Robert E. Barieau 1971 188 p refs
(BM-RI-7468) Avail: NTIS

A computer program for solving two-phase equilibria data for binary mixtures and for evaluating thermodynamic functions of interest, including all critical points is presented. This computer program was used to calculate equilibrium points on the PVTu surface for the helium-nitrogen system as predicted by the Van der Waals equation of state. Numerical values are tabulated and illustrations are presented for 1,279 equilibrium points and for quantities needed to construct Ponchon diagrams. Equilibrium ratios as a function of pressure at constant temperature and of temperature at constant pressure are also shown graphically. In addition, saturated partial molal volume and partial molal enthalpy data are given. It is shown that the Van der Waals helium-nitrogen system exhibits retrograde condensation of the second type for liquid helium concentrations of about 0.07 mole fraction or less and pressures below about 45 atm. It is also shown that the critical point is at a maximum value of pressure (at constant temperature) and of temperature (at constant pressure). Author

N71-36356# Research Inst. of National Defence, Stockholm (Sweden).
PROPAGATION OF THERMAL RADIATION FRONTS FROM AN EXPONENTIAL ENERGY SOURCE
N. Hoernqvist Jan. 1970 20 p refs
(FOA-4-C-4411-25) Avail: NTIS

The characteristics of a thermal radiation front following a nuclear explosion are presented. The problem of determining the propagation of thermal radiation into ambient material at rest is solved mathematically. The governing equation is the radiative diffusion equation by the use of similarity analysis. Author

N71-36359# California Univ., Livermore. Lawrence Radiation Lab.
A TECHNIQUE FOR MEASURING THE PRESSURE, VOLUME, ENTHALPY, AND RESISTANCE OF EQUILIBRIUM THERMODYNAMIC STATES OF LIQUID METALS AT HIGH TEMPERATURES AND PRESSURES
Kenneth W. Henry (Ph.D. Thesis) Apr. 1971 203 p refs
(Contract W-7405-eng-48)
(UCRL-51035) Avail: NTIS

A method for overcoming the temperature and pressure limitations of conventional techniques for measuring equilibrium thermodynamic data was developed. It can be applied to conducting materials that can be resistively heated and that do not disassociate in the liquid phase. A material specimen in the form of a wire 1 mm in diameter by 25 mm long is mounted between two current leads such that it is axially concentric with a high-pressure cell. The cell is filled with helium to the desired working pressure. A current pulse of controlled magnitude and duration, from the overdamped discharge of a high-voltage capacitor bank, heats the wire to the desired state at a rate such that its expansion is nearly isobaric. The energy deposited in a segment of the sample is calculated from data obtained by measuring the current through the sample and the potential difference between two probes spaced about 5 mm apart near the center of the specimen. Author (NSA)

N71-36360# California Univ., Livermore. Lawrence Radiation Lab.
AN ac TEMPERATURE TECHNIQUE FOR MEASURING THE HIGH-TEMPERATURE SPECIFIC HEAT OF METALS
Ronald Matti Finnila (Ph.D. Thesis) 7 Dec. 1970 71 p refs
(Contract W-7405-eng-48)
(UCRL-50962) Avail: NTIS

This technique can be used to measure the specific heat of small wire or foil samples in the temperature range of a few hundred degrees Kelvin to temperatures near the melting point of the sample. The accuracy of the specific heat data obtained using this technique is limited solely by the accuracy of the measurement of the sample's temperature coefficient of resistance. This ac temperature technique was used to measure the specific heat of tungsten in the temperature range 800 to 3400 K. A method for analyzing specific heat data to determine the contribution of lattice mono-vacancies was also developed. This method was used to determine the following data for tungsten: the energy of formation of mono-vacancies; the entropy of formation of mono-vacancies; the concentration of mono-vacancies at the melting point; the migration energy for mono-vacancies; and the anharmonic-lattice specific heat. Author (NSA)

N71-36361*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF PLASTIC SET ON THERMAL CONDUCTANCE AT LIGHT LOADING
Daniel J. McKinzie, Jr. Washington Sep. 1971 5 p refs
(NASA-TM-X-2385; E-6402) Avail: NTIS CSCL 20M

Smooth metal surfaces joined together (e.g., by rivets, bolts, etc.) are commonly encountered in spacecraft. To predict the heat-transfer rates for high-vacuum conditions across such surfaces, the theories of A. M. Clausing and B. T. Chao and B. B. Mikic and W. M. Rohsenow are often used. Experimental data presented indicate that the assumption of elastic deformation made in these theories is inadequate for accurate prediction of heat transfer with light loads. Author

N71-36362# Research Inst. of National Defence, Stockholm (Sweden).
SEISMIC EXPLOSIONS IN JUTLAND, 21-23 SEPTEMBER 1969 [RESERAPPORT. SEISMISKA SPRAENGNINGAR PA JYLLAND 21-23 SEPT 1969]
H. Axelsson Jan. 1970 13 p In SWEDISH
(FOA-4-C-4408-26) Avail: NTIS

A description of a technique for charging and exploding two 1000 kilogram charges of trotyl for measurement of a seismic profile is presented. The explosions also simulate the mechanical and thermal effects of nuclear explosions. Author

N71-36363# Massachusetts Inst. of Tech., Cambridge. Heat Transfer Lab.
FORCED CONVECTION CONDENSATION INSIDE TUBES
Donald P. Travise, Anton B. Baron, and Warren M. Rohsenow 1 Jul. 1971 105 p refs
(DSR-72591-74) Avail: NTIS

High vapor velocity condensation inside a tube was studied analytically. The von Karman universal velocity distribution was applied to the condensate flow, pressure drops were calculated

using the Lockhart-Martinelli method, and heat transfer coefficients were calculated from the momentum and heat transfer analogy. Subsequently, the analysis was reduced to an accurate, but simplified form, to facilitate calculations. Experimental data for refrigerants R-12 and R-22 condensing in a 0.315 in. i.d. tube were obtained. On the basis of the data and analysis, a simplified non-dimensional presentation of the results evolved. The agreement between the majority of the data and the analysis was within + or - 15 percent. Author

N71-36364# Tulane Univ., New Orleans, La. Dept. of Mechanical Engineering.
NON-FOURIER PHENOMENA AND THE RELAXATION MODEL FOR HEAT CONDUCTION
Michael John Maurer (Ph.D. Thesis) 1970 84 p refs
Avail: NTIS

The results are presented of an investigation to determine if the relaxation model for heat conduction would satisfactorily account for the few experimentally observed deviations from the Fourier model. A review is made of those experiments with reported deviations in order to estimate the upper bound of the relaxation time, using the experimental data reported. It is concluded that experimental verification of the relaxation model is exceptionally difficult since only under extraordinary circumstances does the relaxation model predict observable and significant deviations from the Fourier model. D.L.G.

N71-36365# Army Weapons Command, Rock Island, Ill. Research Development and Engineering Directorate.
APPLICATION OF THE FINITE-ELEMENT METHOD TO HEAT-TRANSFER PROBLEMS. PART 2: TRANSIENT TWO DIMENSIONAL HEAT TRANSFER WITH CONVECTION AND RADIATION BOUNDARY CONDITIONS
Technical Report, Aug. 1970 - May 1971
Rao V. S. Yalamanchili and Shih-Chi Chu Jun. 1971 75 p refs
(AD-726371; AMSWE-RE-71-41) Avail: NTIS CSCL 20/13

The transient two-dimensional heat-conduction analysis was prepared by a variational principle and finite-element synthesis. This provided for the use of arbitrary geometry, combination of orthotropic materials, and general boundary-conditions. The finite-element difference expression and the ordinary finite-difference formulae for the Laplacian term were derived. A particular finite-difference formula for the Laplacian term was chosen to bring the difference expressions of finite element, finite difference, and method of weighted residuals (Galerkin) into the same format. The stability criteria were established for all three techniques by use of the general stability, Von Neumann, and Dusinberre concepts. The oscillation characteristics were derived for all three techniques. Various iteration techniques were investigated to represent nonlinear boundary-conditions (radiation). Author (GRA)

N71-36366# Army Weapons Command, Rock Island, Ill. Research Development and Engineering Directorate.
APPLICATION OF THE FINITE-ELEMENT METHOD TO HEAT-TRANSFER PROBLEMS. PART 1: FINITE-ELEMENT METHOD APPLIED TO HEAT-CONDUCTION SOLIDS WITH NONLINEAR BOUNDARY CONDITIONS
Technical Report, Aug. 1970 - May 1971
Shih-Chi Chu and Rao-V. S. Yalamanchili Jun. 1971 51 p refs
(AD-726370; AMSWE-RE-71-37) Avail: NTIS CSCL 20/13

The finite-element method was extended to solid heat conduction with a radiation-convection, nonlinear heat-flux, boundary condition. General finite-element models are developed that enable approximate solutions of transient heat in an arbitrary three-dimensional body subjected to the described initial conditions and nonlinear or linear heat flux across the surfaces of the body. Applications of the present approach involve: (a) heat in a semi-infinite solid with radiation taking place at the surface, (b) transient temperature in a slab subjected to radiation and convection boundary conditions at both surfaces, and (c) heat transfer of a small-caliber multilayer gun tube subjected to time-dependent heat convection and radiation boundary conditions under automatic firing situations. Numerical solutions to the first and the second problem are compared with the exact solution and with results obtained by use of the probability method. Author (GRA)

N71-36367# Ballistic Research Labs., Aberdeen Proving Ground, Md.
ELECTROSTATIC-INSENSITIVE DETONATOR FOR PRECISION SYNCHRONIZATION
Boyd C. Taylor and Giordano Melani Feb. 1971 21 p
(AD-726903; BRL-MR-2066) Avail: NTIS CSCL 19/1

In many regions of the United States, enough electrostatic charge can be accumulated on the human body to initiate certain commonly used military bridgewire detonators. The design of the ARC-211 detonator has been carried forward to where it is insensitive to the highest level of electrostatic energy normally expected on the human body. Measurements of the electrostatic sensitivity of M36A1 detonators are included for comparison. Functioning times of the current model of the ARC-211 detonator are given over the voltage range from 6 to 5,000 volts. At 5,000 volts, the functioning time is 2.42 microseconds, with an estimated standard deviation of 0.045 microsecond. Author (GRA)

N71-36368 National Lending Library for Science and Technology, Boston Spa (England).
THE EFFECTIVENESS OF HEAT TRANSFER TO THE SURFACE OF PLATE FROM A HIGH-TEMPERATURE JET OF COMBUSTION PRODUCTS OF VARIOUS GASES [EFFECTIVNOST TEPLOPERENOSA NA POVERKHNOST PLITY OT VYSOKOTEMPERATURNOI STRUI PRODUCTOV SGORANIYA RAZLICHNYKH GAZOV]
S. N. Shorin et al Jun. 1971 12 p refs Transl. into English from Teoriya i Prakt. Szhiganiya Gaza, Tr. Nauchn.-Tekhn. (Moscow), no. 4, 1968 p 134-143
(NLL-RTS-6531) Avail: Natl. Lending Library, Boston Spa, Engl.: £1.10 or 4 NLL photocopy coupons; SIS 64.05

Results are presented for an investigation of heat transfer when a jet of incandescent gas, at temperatures up to 3000 K, flows over a flat body. The thermal and dynamic properties of jet combustion products from Moscow city gas and liquid gas from cylinders mixed with air (excess air factor 1.05 to 1.6) in the 1000 to 2000 K range were studied. Liquid gas combustion from cylinders of gas mixed with oxygen (excess air factor 1.0 to 1.2) in the 2500 to 3000 K range was also included. Data for the temperature and velocity distributions of a free high-temperature jet corresponded with the theory of turbulent jets. J.M.

N71-36369 National Lending Library for Science and Technology, Boston Spa (England).
VARIATION OF HEAT TRANSFER AND PRESSURE DROP IN TUBE BUNDLES UNDER CROSSFLOW CONDITION CAUSED BY DIFFERENT ROUGHNESSES, ALSO REMARKS ON THE CHOICE OF A REFERENCE TEMPERATURE
H. G. Groehn et al 5 Apr. 1971 14 p refs Transl. into ENGLISH from Proc. of 4th Intern. Heat Transfer Conf. 1970
(NLL-CE-Trans-5511-(9022.08)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

In various tube arrangements the relative roughness K/D of the tubes of .00002 to .004 was varied with Reynolds numbers from 10,000 to 2 million. The roughness affects the heat transfer and pressure loss above a critical Reynolds number. Spoiler fins put on heat exchanger tubes have the effect in the case of an in-line bundle of increasing the heat transfer in the Reynolds range investigated for approximately the same pressure loss. In addition, a reference temperature is given, for which the heat transfer curves determined during heating and cooling coincide. Author

N71-36370 National Lending Library for Science and Technology, Boston Spa (England).
THERMODYNAMICS OF HIGH TEMPERATURE CORROSION: A COMPLEMENT TO LABORATORY AND OPERATIONAL TESTS
R. Resch 5 Apr. 1971 11 p refs Transl. into ENGLISH from Conf. on Corrosion in Refuse Incineration Plants, Duesseldorf, 7-8 Apr. 1970 p 52-59
(NLL-CE-Trans-5606-(9022.09)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The following examples are considered from a thermodynamic point of view in connection with high temperature fire-side corrosion: reduction of the oxide layer on heat exchanger surfaces; chromium as an alloying component; sulphate corrosion including pyrosulphate formation and conversion to complex alkali-iron-sulphates; hydrogen chloride corrosion; phenomena of silicon suboxide and silicon sulphide formation and vanadium pentoxide. Author

N71-36269*# Vought Missiles and Space Co., Dallas, Tex.
THE FLASH EVAPORATOR FOR TRANSIENT HEAT LOADS
J. L. Gaddis *In* NASA. Kennedy Space Center Space Shuttle Technol. Conf., Vol. 2 3 May 1971 p 35-65 (See N71-35266 22-05)
Avail: NTIS CSCL 06K

34 GENERAL

Includes information of a broad nature related in industrial applications and technology, and to basic research; defense aspects; information retrieval; management; law and related legal matters; and legislative hearings and documents.

N71-36371# University of Southern Calif., Los Angeles. Dept. of Electrical Engineering.
INSIGHT: AN INTERACTIVE GRAPHIC INSTRUCTIONAL AID FOR SYSTEMS ANALYSIS
M. J. Merritt and R. Sinclair May 1971 16 p refs
(Grant GM-16197-03)
(TR-71-21) Avail: NTIS

INSIGHT (Instructional Systems Investigation Graphic Tool) is an interactive graphics program which illustrates the basic concepts of systems analysis. The transfer functions, inputs, and parameters of a single loop control system are drawn on the graphic display. Numeric data entry, system modifications and control of the time domain and frequency domain analysis is performed using the graphics terminal's light pen. All communications are problem oriented and no previous computer experience is required. INSIGHT provides a common instructional tool for all disciplines touching upon systems analysis, control theory, and differential equations. Such disciplines might include engineering, physics, mathematics, geology, and chemistry, to name but a few. The common link between all of these fields is the use of Laplace transforms to describe linear components of possibly nonlinear systems, represented as serially connected block elements, with and without feedback. Additional common factors fall into two classes: instructional goals and analysis techniques. Author

N71-36372*# Massachusetts Inst. of Tech., Cambridge. Alfred P. Sloan School of Management.
EXECUTIVE DECISION MAKING IN ORGANIZATIONS: IDENTIFYING THE KEY MEN AND MANAGING THE PROCESS
George F. Farris Jun. 1971 55 p refs *Its* Working Paper No. 551-71
(Grant NGR-23-005-395)
(NASA-CR-121886) Avail: NTIS CSCL 05A

A model of executive decision making is developed which examines a series of decisions made over time and emphasizes the interaction of members of an organization in making these decisions. A review of the literature suggests that members of an organization can facilitate the decision making of their colleagues by performing any one of four colleague roles: thinking facilitator, power equalizer, technical link-pin, and organizational link-pin. The concept of role net is advanced to characterize the informal organization involved in decision making. Two studies are described which illustrate the use of the colleague role approach to executive decision making. In one, some characteristics of the key men in executive decision making are identified, and in the other the performance of colleague roles is related to career development. Several suggestions are made for refinement and extension of colleague role theory. Author

N71-36373*# Massachusetts Inst. of Tech., Cambridge. Alfred P. Sloan School of Management.
COLLEAGUE ROLES AND INNOVATION IN SCIENTIFIC TEAMS
George F. Farris Jul. 1971 25 p refs *Its* Working Paper No. 552-71
(Grant NGR-23-005-395)
(NASA-CR-121885) Avail: NTIS CSCL 05B

The innovation of teams of scientists was related to their colleague role nets, utilizing an executive decision making model. Team innovation tended to be associated with greater performance of technical roles within the team, and the supervisor's being more oriented toward his team and less to outsiders. During the idea suggestion stage, the roles most associated with team innovation were the supervisor's receiving original ideas from more outside sources but having fewer original ideas himself, group members providing each other with technical information, and the availability of organizational information from fewer sources inside or outside the group. During the proposal development stage, high innovation teams tended to be characterized by greater exchange of help among themselves in thinking through technical problems and greater usefulness of their supervisors in critically evaluating their ideas. Author

N71-36374*# Washington Univ., St. Louis, Mo.
EDUCATIONAL ELECTRONIC INFORMATION DISSEMINATION AND BROADCAST SERVICES: HISTORY, CURRENT INFRASTRUCTURE AND PUBLIC BROADCASTING REQUIREMENTS
Jai P. Singh and Robert P. Morgan 9 Aug. 1971 90 p refs *Its* Internal Mem. No. 71/3
(Grant NGL-26-008-054)
(NASA-CR-121910) Avail: NTIS CSCL 05B

The results of a study conducted on electronic educational information dissemination and broadcast services in the United States are presented. Included are detailed discussions of the historical development and current infrastructure, both in terms of organization and physical plant, of the following services: educational radio broadcasting, educational television broadcasting, instructional television fixed services, information retrieval (dial access) television, closed-circuit television, responsive television, and cable television. A series of maps have been plotted which indicate that these services are not distributed uniformly over the entire U.S. Certain areas, such as Alaska, the Rocky Mountain States and to some extent Appalachia, generally characterized as remote or rural areas, tend to have a dearth of services. After reviewing the FCC requirements, and after considering key issues such as regional versus national versus special programming, potential long-haul telecommunications requirements for public television and radio distribution are outlined. Author

N71-36375*# International City Management Association, Washington, D.C. Technology Application Program.
[AEROSPACE TECHNOLOGY DISSEMINATION TO LOCAL GOVERNMENTS] Semiannual Report, 3 Feb. - 2 Aug.

1971
2 Aug. 1971 53 p
(Contract NASw-2170)
(NASA-CR-122035) Avail: NTIS CSCL 05B

The Technology Application Program (TAP) was established in cooperation with the International City Management Association (ICMA) to serve the research and development needs of U.S. cities and to provide a channel in which cities may communicate their technological desires to the NASA scientists and engineers. The report presents an outline of the program's objectives and proposes steps for transferring technology to the cities. J.G.M.

N71-36376*# Technical Operations, Inc., Burlington, Mass.
MULTIPLE IMAGE OVERLAY STORAGE METHODS Final Technical Report, 11 Aug. 1970 - 11 May 1971
Peter F. Mueller Jun. 1971 107 p refs
(Contract NAS5-21302)
(NASA-CR-122069; TO-B71-15) Avail: NTIS CSCL 05B

The image quality achievable with available optical multiplexing techniques is investigated. The study was conducted over a nine-month period and was restricted to 35 millimeter image formats and up to twelve channel multiplex recordings. The results indicate that seven carrier-modulated images can be overlayed on a single film frame and retrieved subetantially free from crosstalk and dimensional distortion. Resolution was maintained at 10 line-pairs per millimeter, and the gray scale was reproduced essentially linear over a 100 to 1 brightness dynamic range. Based on these results, it is recommended that the techniques be demonstrated with seven spectral zones of ERTS imagery in spatial registration at full size format. Author

N71-36377# RAND Corp., Santa Monica, Calif.
AN EXTENDED CONCEPT OF MODEL
E. S. Quade Jul. 1970 13 p refs
(P-4427) Avail: NTIS

Arguments are presented refuting the cruciality of mathematical formulation of models for operations research applications where factors are obscure and difficult to define. A reliance on expert judgment and intuition is stressed as being significant for this situation. Operational gaming is cited as an example of an accepted operations research technique which does not rely on mathematical formulation. The Delphi procedure is discussed in detail as an example of an expansion of the model concept to include any device that provides a logical means to predict and compare the outcome of alternative actions, regardless of its representative features or how efficient it is at optimization. J.G.M.

N71-36378# Massachusetts Inst. of Tech., Cambridge.
CLEAN AIR CAR RACE, 1970 Summary Report
Feb. 1971 279 p
(Contract EPA-CPA-70-169)
(PB-199479; APTD-0680) Avail: NTIS CSCL 13B

A brief discussion of sources and health effects of air pollution and of current control procedures for internal engine combustion exhaust. A synopsis of events leading to the 1970 Clean Air Car Race, and a summary of achievements and impacts of the race are presented. A discussion of the winners of the CACR; the classification of the vehicle power plants, selection procedure for the winners, and other pertinent facts about the class winners and the overall winner are included. The performance test procedures for CACR vehicles are outlined, followed by a detailed discussion of the exhaust emission standards and CACR test procedures. The automotive fuel used in the race and the actual costs of the race are also discussed. Author

N71-36379# Florida Univ., Gainesville.
QUANTUM THEORY PROJECT FOR RESEARCH IN ATOMIC, MOLECULAR AND SOLID-STATE CHEMISTRY AND PHYSICS
1 Apr. 1971 65 p Report from the Winter Inst. in Quantum Chem., Solid-State Phys. and Quantum Biol.; Intern. Symp. on Atomic, Molecular, Solid-State Theory and Quantum Biol., 7 Dec. 1970 - 23 Jan. 1971, and the Annual Progress Report from the Quantum Theory Project, 1970-1971
(Rept-224) Avail: NTIS

Quantum science, its philosophy, conceptual structure, and applications to materials research, properties of upper space, cellular biology, and internal medicine, is discussed. E.H.W.

N71-36380# Bureau of Labor Statistics, Washington, D.C.
AIRLINE EXPERIENCE UNDER THE RAILWAY LABOR ACT
1971 55 p refs /ts Bull. No. 1683
Avail: SOD $0.55

A descriptive and statistical account of the industrial relations, mediation, work stoppage, and emergency dispute experience of the airlines under the Railway Labor Act is provided. Published and unpublished records were utilized to conduct a more comprehensive analysis than had been available. Author

N71-36381# Aircraft Research Association, Ltd., Bedford (England).
REPORTS CATALOGING AT THE AIRCRAFT RESEARCH ASSOCIATION
C. C. Barnett Jul. 1971 19 p refs
(Rept-22) Avail: NTIS

A computer produced cataloging and subject indexing system for report material acquired by the Aircraft Research Association Library is described. Keyword listings with indexes under author and orginators, references will be used to produce a monthly accessions list, monthly and annual cumulating catalogs. The keywords will be supplied manually by using a specially constructed thesaurus. Author

N71-36382# Advisory Group for Aerospace Research and Development, Paris (France). Structures and Materials Panel.
DIRECTORY OF ORGANIZATIONS, INVESTIGATORS, AND PROGRAMS IN HIGH TEMPERATURE CORROSION RESEARCH
Aug. 1971 26 p
(AGARD-R-585-71) Avail: NTIS

Organizations are listed together with investigators and specific research areas in the field of high temperature corrosion. The list includes 176 organizations from eleven NATO countries and Spain. A category index indicates the area in which the various organizations are conducting research. Two areas receiving the most attention are material behavior under corrosion and reaction kinetics and diffusion processes. Author

N71-36383# Committee on Science and Astronautics (U. S. House).
AUTHORIZATION FOR FIRE RESEARCH AND SAFETY AND THE STANDARD REFERENCE DATA ACTS (H.R. 7199-H.R. 7189)
Washington GPO 1971 40 p refs Hearing before Comm. on Sci. and Astronaut., 92d Congr., 1st Sess., No. 8, 3 Aug. 1971
Avail: Subcomm. on Sci., Res., and Develop.

Subcommittee testimony presented during the hearing to consider the authorization request for funds for continuing work under the Fire Research and Safety and Standard Reference Data Acts is documented. J.G.M.

N71-36384# National Bureau of Standards, Washington, D.C.
POSTDOCTORAL RESEARCH ASSOCIATESHIPS
1971 100 p
Avail: NTIS

The functions and interests of the divisions of the Institute for Basic Standards are briefly summarized to indicate the areas in which awards in postdoctoral research are offered. The

divisions are applied mathematics, electricity, heat, mechanics, optical physics, cryogenic, electromagnetics, quantum electronics, time and frequency. F.O.S.

N71-36385# Committee on Science and Astronautics (U. S. House).
SCIENCE, TECHNOLOGY, AND THE ECONOMY
Washington GPO 1971 164 p refs Hearings before Comm. on Sci. and Astronaut., 92d Congr., 1st Sess., No. 7, 27-29 Jul. 1971
Avail: Subcomm. on Sci., Res., and Develop.

The hearings were held to explore the effects of science and technology on the economy of the U.S. and the rest of the world. The Committee was particularly interested in determining the total resources that should be invested in research and development, and the optimum ways for making these investments. The complete text of these proceedings is presented. J.G.M.

N71-36386# National Industrial Pollution Control Council, Washington, D.C.
THE ENGINEER'S RESPONSIBILITY IN ENVIRONMENTAL POLLUTION CONTROL
Mar. 1971 19 p
Avail: NTIS

The engineer's responsibilities toward protection and control of the environment are studied. The recommended duties the engineer should assume include: coordinate and unify control efforts, provide technical leadership, evaluate costs of pollution control, identify manpower needs, and participate in the development of a national commitment. F.O.S.

N71-36387# National Industrial Pollution Control Council, Washington, D.C.
EXHAUST EMISSIONS FROM GAS TURBINE AIRCRAFT ENGINES
Feb. 1971 28 p
Avail: NTIS

Air pollution by gas turbine aircraft engines is discussed. The emissions that are considered air pollutants, include: smoke and particulate matter, carbon monoxide, nitrogen oxides, unburned and partially oxidized hydrocarbons, and sulfur oxides. The emission extent, airport conditions, odors, and fuel vapors are also discussed. It is recommended that programs to obtain better definition of the meteorology and atmospheric chemistry and physics in the upper atmosphere should be accelerated. F.O.S.

N71-36388# National Industrial Pollution Control Council, Washington, D.C.
NOISE FROM GAS TURBINE AIRCRAFT ENGINES
Feb. 1971 24 p
Avail: NTIS

The reduction of aircraft noise at airports is discussed in terms of jet exhaust noise. Improvements to suppress noise are presented and include the operational procedures of routing approach and takeoff turns away from populated areas. It is concluded that no immediate breakthroughs are foreseen and further noise reduction will be achieved only in small increments. F.O.S.

N71-36389# National Industrial Pollution Control Council, Washington, D.C.
COUNCIL REPORT
Feb. 1971 52 p
Avail: NTIS

The organization, operations, and activities of the Industrial Council are discussed along with the status and nature of the abatement of industrial pollution problems. One of the environmental economical policy observations presented is the recommendation against any system for selling the rights to pollute the environment. F.O.S.

N71-36390# Royal Aircraft Establishment, Farnborough (England).
SWEDISH DEFENCE RESEARCH ABSTRACTS, ISSUE 70/71-1 [FROE FOERSVARS FORSKNINGS REFERAT, OEPPEN DEL 70/71-1]
Apr. 1971 36 p
(RAE-Lib-Trans-1570) Avail: NTIS

Titles of reports and informative abstracts which were translated into English are presented for the first quarter of 1971. The main topics covered are studies (systems analysis) of nuclear reactions; chemical and biological warfare; conventional warfare; applied physics; electronics; biotechnology; other investigations; military psychology, and psychological defense. Author

N71-36391# Committee on Science and Astronautics (U. S. House).
NATIONAL BUREAU OF STANDARDS: REVIEW OF ITS ORGANIZATION AND OPERATIONS
Dorthy M. Bates (Library of Congr.), Warren H. Donnelly (Library of Congr.), and Charles S. Sheldon, II (Library of Congr.) Washington GPO 1971 231 p refs Presented to Comm. on Sci. and Astronaut., 92d Congr., 1st Sess, 8 Sep. 1971 Prepared by Library of Congr., Sci. Policy Res. Div.
Avail: Subcomm. on Sci., Res., and Develop.

A review of the organizational structure and the services of the National Bureau of Standards is presented to the Committee on Science and Astronautics. E.H.W.

N71-36392# Forsvarets Teleteknieska Lab., Stockholm (Sweden).
REPORT ON ATTENDANCE AT THE FOURTH NATO SYMPOSIUM ON CODIFICATION OF EQUIPMENT IN LONDON FROM 15 TO 19 SEPTEMBER 1969 [RAPPORT OEVER DELTAGANDE I FOURTH NATO SYMPOSIUM ON CODIFICATION OF EQUIPMENT I LONDON 15-19 SEPT. 1969]
T. Gussing Feb. 1970 30 p Partly in SWEDISH and partly in ENGLISH
(FTL-A-A00-1) Avail: NTIS

A standard method of numbering, naming, and describing items of supply which can be used by all NATO nations is described. The data system is adaptable to the fastest methods of interrogation, data retrieval, and data transmission by Electronic Data Processing. The numerical codification of the hardware items is presented and recommendations for improvement are discussed. P.N.F.

N71-36393# Bureau of Mines, Washington, D.C.
REVIEW OF BUREAU OF MINES ENERGY PROGRAM, 1970
Bill Linville and John D. Spencer 1971 119 p refs
(BM-IC-8526) Avail: NTIS

A program of research to help U.S. industry meet the energy demands for fuels, electrical power, and chemicals during the 1970's is discussed. Subjects presented are: (1) solid waste utilization and disposal, (2) coal mine safety, (3) coal storage and shipment, (4) electric power generation from coal, (5) chemicals from coal carbonization,(6) fuels and chemicals by synthesis processes, (7) petroleum and natural gas production, and (8) oil shale utilization. Author

N71-36394# Committee on Science and Astronautics (U. S. House).
APOLLO 15 MISSION REPORT
Washington GPO 1971 40 p Hearings before Comm. on Sci. and Astronaut., 92d Congr., 1st Sess., no. 9, 9 Sep. 1971
Avail: Comm. on Sci. and Astronaut.

Statements of the Apollo 15 astronauts to the Committee of Science and Astronautics concerning their lunar mission are reported. Their activities on the lunar surface were discussed with emphasis on the Lunar Rover. F.O.S.

N71-36395# Committee on Commerce (U. S. Senate).
LOCAL AIR SERVICE TO SMALL COMMUNITIES
Washington GPO 1970 489 p refs Hearings before Comm. on Com., 91st Congr., 2d Sess., 10 Apr., 13 Apr., 27-28 May, 19 Jun., and 24 Aug. 1970 *Its* Serial No. 91-100
Avail: Subcomm. on Aviation

The adequacy of schedules, reliability of flights, and the economics involved in air service to small communities and towns are discussed before the Aviation Subcommittee. The hearings were held to determine if a reappraisal of Federal policy in this area is needed. E.H.W.

N71-36396# University of Southern Calif., Los Angeles.
ON THE GROWING PAINS OF GIANTS: AN ESSAY ON LARGE SYSTEMS
Richard Bellman Jun. 1971 47 p refs
(Grant NSF GP-20423; Contract AT(11-1)-1113)
(USC-113P19-11; TR-71-28) Avail: NTIS

Some aspects of the influence of the computer and mathematical ideas on possible structures of society are discussed. Scientific systems are examined in considering the question of how far strictly rational and logical techniques can be used in the administration of inanimate systems. It was suggested that even with the aid of modern science, reinforced by control theory, the use of human judgment is critical in the use of computer operation of engineering systems. Social systems are discussed relative to problems encountered in dealing with humans. Specifically, it is emphasized that a mathematical analysis demonstrates that only the human mind can cope with human problems. It is concluded that a decentralization of society is required as well as a sophisticated attitude towards the behavior of systems. Author

N71-36397# National Academy of Sciences-National Research Council, Washington, D.C. Maritime Transportation Research Board.
LEGAL IMPEDIMENTS TO INTERNATIONAL INTERMODAL TRANSPORTATION: SELECTED PROBLEMS, OPTIONS, AND RECOMMENDED SOLUTIONS Final Report
Mar. 1971 203 p refs
(Contract N00014-67-A-0244-0023)
(AD-726797) Avail: NTIS CSCL 05/4

Solutions to legal impediments to international intermodal transportation are defined and suggested. The areas of through rates and regulation, through documentation, and through responsibility and liability are emphasized. Related aspects of the federal regulatory structure, antitrust considerations, international treaties and negotiations, and U.S. national transportation policy are also treated. Inland carriers are considered in the context of their participation in international through movements. The focus is on cargo transportation by common carriers. Modes of analysis included invited briefings and panel discussions, draft review by three regional councils, assistance from a computerized legal information retrieval system, and a shipper questionnaire. This questionnaire was designed to assess the extent to which some of the readily identifiable legal impediments are viewed as serious commercial problems. A summary of the response to the questionnaire is included. Author

N71-36283*# Computer Sciences Corp., Silver Spring, Md.
NASTRAN DOCUMENTATION FROM AN HISTORICAL VIEWPOINT
Frank J. Douglas *In* NASA. Langley Res. Center NASTRAN: Users Experiences Sep. 1971 p 517-531 refs (See N71-36253 22-32)
Avail: NTIS HC $9.00/MF $0.95 CSCL 05B

N71-393864 Committee on Science and Astronautics (U. S. House)
SCIENCE, TECHNOLOGY, AND THE ECONOMY
Washington GPO 1971 164 p refs Hearings before Comm. on Sci. and Astronaut., 92d Congr., 1st Sess., No. 7, 27-29 Jul. 1971
Avail. Subcommittee on Sci., Res., and Develop.

The hearings were held to explore the effects of science and technology on the economy of the U.S. and the rest of the world. The Committee was particularly interested in determining the total resources that should be invested in research and development, and the optimum ways for making these investments. The complete text of these proceedings is presented. J.G.M.

N71-393865 National Industrial Pollution Control Council, Washington, D.C.
THE ENGINEER'S RESPONSIBILITY IN ENVIRONMENTAL POLLUTION CONTROL
Mar. 1971 19 p
Avail. NTIS

The engineer's responsibilities toward protection and control of the environment are studied. The recommended duties the engineer should assume include: coordinate and lead societal efforts, provide technical leadership, evaluate costs of pollution control, identify manpower needs, and participate in the development of a national commitment. F.O.S.

N71-393871 National Industrial Pollution Control Council, Washington, D.C.
EXHAUST EMISSIONS FROM GAS TURBINE AIRCRAFT ENGINES
Feb. 1971 39 p
Avail. NTIS

Air pollution by gas turbine aircraft engines is discussed. The emissions that are considered as pollutants include smoke and particulate matter, certain oxidized nitrogen species, unburned and partially oxidized hydrocarbons, and sulfur oxides. The analytical system, engine conditions, odors, and fuel vapors are also discussed. It is recommended that programs to obtain better definition of the meteorology and atmospheric chemistry and physics in the upper atmosphere should be accelerated. F.O.S.

N71-393872 National Industrial Pollution Control Council, Washington, D.C.
NOISE FROM GAS TURBINE AIRCRAFT ENGINES
Feb. 1971 24 p
Avail. NTIS

The reduction of aircraft noise at airports is discussed in terms of jet exhaust noise, improvements to airports in urban areas via planning, and include the operational procedures of routing flights and distributing them away from populated areas. It is concluded that no unrealized breakthroughs are foreseen and further noise reduction will be achieved only in small increments. F.O.S.

N71-393873 National Industrial Pollution Control Council, Washington, D.C.
COUNCIL REPORT
Feb. 1971 40 p
Avail. NTIS

The organization, operations, and activities of the Industrial Council are discussed along with the status and nature of the abatement of industrial pollution problems. One of the environmental economical policy considerations presented is the recommendation against any system for selling the rights to pollute the environment. F.O.S.

PUBLIC COLLECTIONS OF NASA DOCUMENTS

DOMESTIC

NASA deposits its technical documents and bibliographic tools in eleven Federal Regional Technical Report Centers located in the organizations listed below. Each center is prepared to furnish the public such services as reference assistance, interlibrary loans, photocopy service, and assistance in obtaining copies of NASA documents for retention.

CALIFORNIA
University of California, Berkeley

COLORADO
University of Colorado, Boulder

DISTRICT OF COLUMBIA
Library of Congress

GEORGIA
Georgia Institute of Technology, Atlanta

ILLINOIS
The John Crerar Library, Chicago

MASSACHUSETTS
Massachusetts Institute of Technology, Cambridge

MISSOURI
Linda Hall Library, Kansas City

NEW YORK
Columbia University, New York

PENNSYLVANIA
Carnegie Library of Pittsburgh

TEXAS
Southern Methodist University, Dallas

WASHINGTON
University of Washington, Seattle

NASA publications (those indicated by an "*" following the accession number) are also received by the following public and free libraries:

CALIFORNIA
Los Angeles Public Library
San Diego Public Library

COLORADO
Denver Public Library

CONNECTICUT
Hartford Public Library

DELAWARE
Wilmington Institute Free Library, Wilmington

MARYLAND
Enoch Pratt Free Library, Baltimore

MASSACHUSETTS
Boston Public Library

MICHIGAN
Detroit Public Library

MINNESOTA
Minneapolis Public Library
James Jerome Hill Reference Library, St. Paul

MISSOURI
Kansas City Public Library
St. Louis Public Library

NEW JERSEY
Trenton Public Library

NEW YORK
Brooklyn Public Library
Buffalo and Erie County Public Library
Rochester Public Library
New York Public Library

OHIO
Akron Public Library
Cincinnati Public Library
Cleveland Public Library
Dayton Public Library
Toledo Public Library

OKLAHOMA
Oklahoma County Libraries, Oklahoma City

TENNESSEE
Cossitt-Goodwin Libraries, Memphis

TEXAS
Dallas Public Library
Fort Worth Public Library

WASHINGTON
Seattle Public Library

WISCONSIN
Milwaukee Public Library

An extensive collection of NASA and NASA-sponsored documents and aerospace publications available to the public for reference purposes is maintained by the American Institute of Aeronautics and Astronautics, Technical Information Service, 750 Third Avenue, New York, New York 10017.

EUROPEAN

An extensive collection of NASA and NASA-sponsored publications is maintained by the National Lending Library for Science and Technology, Boston Spa, Yorkshire, England. By virtue of arrangements other than with NASA, the National Lending Library also has available many of the non-NASA publications cited in *STAR*. European requesters may purchase facsimile copy or microfiche of NASA and NASA-sponsored documents, those identified by both the symbols "#" and "*", from: ESRO/ELDO Space Documentation Service, European Space Research Organization, 114, av. de Neuilly, 92-Neuilly-sur-Seine, France.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
WASHINGTON, D. C. 20546
OFFICIAL BUSINESS

FIRST CLASS MAIL

POSTAGE AND FEES
NATIONAL AERONAUT
SPACE ADMINISTRA

POSTMASTER: If Undelivérable (
Postal Manual) D

NEW NASA PUBLICATIONS

The Development of Cryogenic Storage Systems for Space Flight (NASA SP–247)

A report prepared by the NASA Manned Spacecraft Center to trace cryogenic technology from its inception through the Gemini Program, the Apollo Program, and the Apollo Applications Program (Skylab), and to give some estimate of the role of cryogenics in the future. The authors are Michael L. Davis, Robert K. Allgeier, Jr., and Gordon Rysavy of the Manned Spacecraft Center, and Thomas G. Rogers of ITT Federal Electric Corporation. *Paperbound.* 136 pp. Available from Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, for $1.50.

Hypogravic and Hypodynamic Environments (NASA SP–269)

The proceedings of a symposium sponsored by NASA and conducted by Indiana University, June 16–18, 1969, to examine problems of the manned spaceflight environment characterized by physical inactivity, confinement, isolation, and weightlessness. The symposium brought together for the first time in one place most of the principal investigators, in this country and abroad, interested in the use of bed rest to simulate weightlessness. The results show that physiological findings during bed rest parallel most measurements obtained during or after manned spaceflight. More importantly, studies during recumbency point to problems in metabolism and circadian dysrhythmia that were not anticipated as areas for concern in spaceflight. The term "hypodynamic" is used to describe any state of reduced physical input to, or reduced activity of, the subject; "hypogravic" refers to a specific hypodynamic condition in which the reduced input is acceleration due to gravity. *Paperbound.* 398 pp. For sale by the National Technical Information Service, Springfield, Va. 22151, for $6.00.

Scientific and Technical Information Office
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
Washington, D. C. 20546